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LIGHT ✦ HEAT ✦ POWER ✦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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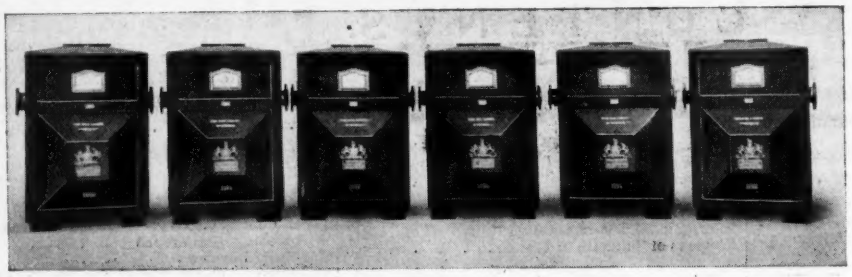

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VOL. CLXIX., No. 3222.] WEDNESDAY, FEBRUARY 11, 1925. [77TH YEAR.

EDITORIAL NOTES.

Gas Wages Dispute—Unions and Arbitration.

THE position of the wages dispute in the gas industry has now reached a critical stage, but not an alarming one, because we feel that the differences that exist should be capable of composure by the men who have dealt so judiciously with the affairs of the industry's workers since the Joint Industrial Council was formed. The situation at the moment is that the Unions have rejected the proposal of the Federation of Gas Employers—that the claims made by the Unions on behalf of the workers as well as the counter-claim of the employers should be submitted to arbitration. The Unions are only willing to go to arbitration on their particular claims, with the reservation that they would not be prepared to discuss any further agreement until after the arbitration had taken place. It is perfectly clear that if the Unions felt they had a strong case, there would be no objection to the claims of both sides going before an Arbitration Court; and there would be no necessity for them to declare (as they have done) their unpreparedness to discuss any further agreement until after the arbitration on their own claims had taken place. Their proposal is altogether inequitable. What they want to do is to block the employers' claims from discussion or decision by an Arbitration Court; and then, if they fail to substantiate their own claims, they desire to have the opportunity of obtaining concessions from the employers by declining to enter into any national agreement save upon their own terms. That is the plain English of their decision. As we say, it does not show strength; and, taking a perfectly dispassionate view of the position, it does not strike us, nor will it other independent people, as containing the elements of fair play. Frankly we can only think that the decision has been hastily arrived at, and that more mature consideration by men whom we respect will lead them to the view that this is a good opportunity to thresh out the whole matter through the submission of the dual claims to a competent tribunal—bearing in mind the statement of the Federation of Gas Employers that though the position of the industry is such as would clearly warrant a reduction in wages, they "are prepared to forego any claim for a reduction at the present moment, provided that the sliding-scale is modified." It was stated at the end of last week that a meeting of the Executives of the four Unions who are parties to the dispute is to be held to consider a general policy for united action. That meeting may have been already held. Whether or not it has been, we can only hope that the amicable relations of the past have had, or will have, influence upon their decisions.

Without discussing the merits or otherwise of the rival claims, it may be useful to place on record here the steps which have led to the present situation and disagreement. For upwards of three years wages in the gas industry have been regulated by a sliding-scale founded on the cost-of-living figures. This plan was adopted by the Joint Industrial Council on Oct. 26, 1921. The slide up or down was ½d. per hour for every complete variation of six points in the cost-of-living index figures. The slide commenced at the figure of 128, and the first reduction was made on and from Nov. 7, 1921, based on the average cost-of-living figures for the preceding months of June, July, and August. The adjustments were to be made each time on the average of the preceding three months; but each full six points only were to be calculated. The adjustments were also to carry the 12½ p.ct. bonus proportionately. Each side was to have the right to terminate the agreement by giving three months' notice in writing expiring on any quarter day, or a month's notice in writing could be given if the average cost-of-living figure for any three months fell below 70. Intermittently, amendments have been made in the terms of the original agreement, but invariably in favour of the workers, with on the side of the employers periods free from change. For example, on July 25, 1922, it was resolved that when the average of the cost-of-living figures for three months was below 86, the rise or fall should be on seven points instead of six. It was then agreed that no notice should be given for a period of six months, and that the figure of 72 should be substituted for 70 in the principal agreement. About a year later—June 21, 1923—it was agreed that a reduction then due of a ½d. per hour, *plus* the 12½ p.ct. thereon, should be made on the following Sept. 1, and that wages should then remain unaltered until April 1, 1924—both sides waiving their right until Jan. 1, 1924, to give any notice to terminate the agreement. That decision did not have effect so long as six months. Before the end of 1923, the working of the sliding-scale was giving dissatisfaction to both sides; and a Joint Committee was appointed to consider the question of its amendment or the instituting of some new arrangement for regulating wages. In January, 1924, the sliding-scale was amended. Wages were increased as from Jan. 1 by ½d. per hour. It was also agreed that, when the average cost-of-living figures as determined in accordance with the provisions of the principal agreement rose to 79, wages should be increased by a further ½d. per hour. If the average figure rose to 80, the employees' side, it was agreed, would be justified in making application to discuss a further increase in wages. But no reduction of wages was to take place from the average cost-of-living figure of 79 downwards until the figure of 65 was reached, when wages were to be reduced by ½d. per hour. Further, if the average figure reached 60, the employers' side would, it was agreed, be justified in making a request to discuss a further decrease in wages. On March 12 last year, it was reported to the Joint Industrial Council that the sliding-scale agreement should be continued until Dec. 31, when three months' notice might be given to terminate it. That notice was given by both sides—by the workers on the ground that the agreement was not sufficiently favourable to them, and by the employers on the ground that the sliding-scale was onerous to them, particularly in view of the serious slump in the secondary products markets, which might affect the price of gas throughout the country.

That in brief is the history of the sliding-scale agreement for regulating wages in the industry. Now as to the current claims of the Unions, and the counter-claims of the employers. The Unions are asking that there shall be an increase in wages of 12s. per week; time-and-a-quarter for all night shift work; and extension of holidays to fourteen days per annum. It is stated that the Unions control between 70,000 and 80,000 gas workers. Taking the lower figure for computation purposes, the claim for an increase of 12s. a week in wages would alone mean (without considering other claims) an additional burden

for the industry of £2,184,000 per annum. Those are the only claims upon which the Unions are prepared to go to arbitration, with an intimation that they are unwilling to discuss any further agreement until after the arbitration. The claims were under consideration of the Management Committees of the District Committees of the Federation of Gas Employers last Wednesday. The result of the meeting was to the effect that the employers' representatives on the Joint Industrial Council should offer to arbitrate on the claims of the Unions, provided that the employers' claim was decided at the same arbitration. This claim is that the wages of gas workers should be regulated upwards or downwards by a sliding-scale based on the average cost-of-living figures, over the usual three-monthly periods, in a manner similar to that which has been in operation previously, but with this difference: That the slide should be ½d. per hour for every six points, and should operate automatically without a neutral zone. The result of this would be that when the average cost-of-living figure over the three-monthly period reached 78, there would be a reduction of ½d. per hour, and when the average cost-of-living figure reached 85, there would be an increase of ½d. per hour, and so on each way. This is the claim the workers' side have refused to include in the arbitration; they say they are definitely against the sliding-scale. Hence the deadlock. The fact should be emphasized that at the meeting of the Management Committees of the District Committees of the Federation of Gas Employers, every district was represented. The representatives are all experts in wages matters. Consequently, their decision clearly represents the general opinion of the gas industry; and there will be no question as to the Federation having its complete support.

In what has been said so far, we have refrained from comment upon the merits of the respective claims, as we are hopeful, as is the Governor of the Gas Light and Coke Company (Mr. D. Milne Watson), that, between now and the end of the present agreement on March 31, accruing light on the situation will have a beneficial effect. There is one statement, however, by Mr. Arthur Hayday, Vice-President of the General and Municipal Workers' Union, to which we may refer. Alluding to the question of the ability of the industry to meet the wages increase which the Unions demand, he says that the average increase in the cost of gas to the consumer is only 50 p.ct. above pre-war price, and the information of the Union is that in some cases the increase is only 36 p.ct. At last Friday's meeting of the Gas Light and Coke Company, the Governor stated that gas workers are receiving from 80 to 120 p.ct. above pre-war wages; and therefore in their case the increased cost of living has been fully met. This being so, there ought to be satisfaction on the part of the workers that the price of gas is only higher than pre-war by 50 p.ct. Conscientious dealing with the consumers in the matter of price has been of material value to the working classes of the country; but since current prices were fixed, the economic position of the industry has seriously altered, and the prospects are very indefinite. Tar and sulphate of ammonia have fallen considerably in value, and so has coke. In the first part of last year, owing to the railway strike, there was a large demand for coke, but in the second half of the year prices fell heavily. The lower prices are ruling to-day, and no one can say positively that bottom has been reached. Exports, too, have fallen. Then the price of coal is an uncertain factor. The miners are out for higher wages without giving any more output than they are to-day—17 to 18 cwt. per man shift, or 3 cwt. short of the pre-war output! The price of gas is controlled in major part by the cost of coal and the market values of the secondary products, and not by the labour of the workers. The ability of the industry to meet the demands of the Unions, we are afraid, exists more in imagination than in fact. It should also be remembered that the industry is subject to the competition of electricity, and that there is talk of the Government aiding that industry to become more effective in its operations. In view of that competition, it is imperative that the price of gas should be continued at as low a point as possible for the well-being of the industry, and the maintenance and (we hope) increase of employment in it. As things are, however, gas prices are seriously threatened.

Confidence in Horseferry Road.

THERE was an atmosphere of considerable confidence at the meeting of the proprietors of the Gas Light and Coke Company last Friday. The faith of the stockholders in their Board would not allow their tranquillity to be in the least disturbed by the facts that there are differences of opinion as to wages to be cleared up with the Trade Unions identified with the industry, that the secondary products of coal carbonization have entered upon a lean period, and that the biggest and boldest scheme of amalgamation in gas enterprise ever conceived is about to be considered by Parliament, through which, if endorsed by the Legislature, the Gas Light Company will take unto themselves all the rights and obligations of the Brentford Gas Company (which concern has been during the last few years enlarging its borders by the process of absorption). One might have expected in view of happenings, present and future, that there would have been an abnormal meeting in respect of numbers and inquisitiveness. Nothing of the kind. The meeting was normal in numbers; there was no criticism, no material interrogation; but the confidence that has been established between the Board and proprietors over a good course of years is fully maintained in the face of these momentous movements. And the greatest of these is the amalgamation which Parliament is about to be asked to sanction. As has been pointed out previously in these columns, there will be mutual advantage in what is proposed in this respect. The big Gas Light Company naturally want more freedom; and this can only be obtained by carrying its operations into Greater London and the suburbs. On the other hand, the Brentford Company will gain the economies which the large neighbour can offer by their sea transport facilities, and progressively by the manufacturing, purchasing, and selling concentration that will ensue. Probably by the next annual meeting the fusion will have been accomplished, though the maturing of the effects will be a matter of time.

Popularly considered, the most interesting part of the address is that in which the Governor (Mr. D. Milne Watson) dealt with the increase of the gas business, and the position that gas holds as a public servant in contrast with electricity, apart, of course, from traction, although even in that respect the gas industry can make good showing through benzole, and could make a better one did it pay to remove that motor spirit completely from town gas. Last year the Company had a record sale of gas, and Dec. 10 was a record day with its output of 166 million c.ft. In the year there was an increase in sales of 6½ p.ct., which quantitatively is represented by 2000 million c.ft., or, expressed as heat energy, 10 million therms. Naturally this has necessitated considerable expenditure—capital and otherwise; moreover, the Company are not hesitating to spend money on eliminating old-fashioned cookers and fires and substituting the more modern types of greater efficiency. The situation, so far as the gas business is concerned, is a healthy one, leaving out of consideration the effects of the changed condition in respect of secondary products. Some people suffer from the delusion that gas is moribund. That was a little distortion of the mind which was rather prevalent among electrical people at one time of day; but a better knowledge of facts has had more or less corrective influence. Where the misconception still exists, certain points in the Governor's address should have a salutary effect. We have known electrical men to labour under the belief that no gas is now used in Bond Street and Piccadilly; but the fact is that in those areas 20 p.ct. more business is done by the Company than twenty years ago. Again, in the Harley Street district, more gas is used per square mile for domestic purposes than in any other part of London. And what of the hotel that 35 years ago advertised that "no gas" was used on the premises, and to-day consumes gas to the extent of a million c.ft. per month?

Last year the Governor made our electrical friends open their eyes, and ejaculate expressions of astonishment, by giving them the information that the Gas Light and Coke Company alone produce in a year approximately as much energy for light, heat, and power as is produced in the form of electricity by the whole of the electrical undertakings in Great Britain. We believe that one electrical jour-

nalist when he read the statement had to pinch himself to ascertain that he was really awake. But though there were a few little ineffective darts thrown at the solid fact, nothing could be advanced to controvert it or to diminish its truth. This year another comparison is made by the Governor, which will cause our friends "furiously to think"—and in more senses than one. Here it is:

> For the vast quantity of heat units that were supplied by this Company during the year for all purposes—viz., 183,000,000 therms, the consumers paid just over £6,000,000. Were the electricians called upon to replace the use of this gas by electricity, it would mean that they would have to furnish a supply of over 5000 million Board of Trade units; and if those units were to be sold at a total cost to the consumer of £6,000,000, it would be necessary for the charge per unit to be in the neighbourhood of a farthing.

Our legislators, as well as electrical friends, should consider those facts, combined with the one that even if 5000 million units could be generated at the rate of 1000 units per ton of coal used (or 2·24 lbs. of coal per unit), no less than 5 million tons of coal would have to be used for the purpose, instead of the 2,192,291 tons carbonized last year by the Company, from which coal various valuable products besides gas were realized.

Several other topics were woven into the highly interesting address, among them being the new situation which has developed as to labour, which is touched upon in the first editorial article to-day.

Popularity of Gas, but Uncontrollable Secondary Products.

THESE two things the past year's accounts of the South Metropolitan Gas Company demonstrate very forcibly [see *ante* p. 271]; and there is no doubt the proprietors will hear more about them at their meeting to-day. We can imagine that the two facts will be uppermost in the mind of the President of the Company (Dr. Charles Carpenter) as he addresses the meeting, because if there is one thing more than another upon which the Directors pride themselves, it is to honour the triple alliance to the utmost of their power by supplying gas to the consumers at the lowest possible cost; indeed, to them it is repugnant to have to retrace their steps to a higher price, after having worked hard to realize a lower one. But conditions in respect of secondary products have to alter very much, and that fairly rapidly, if the Company are to maintain the existing charge of 8d. per therm to the ordinary consumers, especially when there is a tendency for the wages curve to ascend, and the outlook in this respect in both the coal and gas industries is somewhat cloudy. In their report the Directors mention the heavy fall in the values of secondary products; and they add: "When, in addition, it has to be recorded that wages are again on the upward grade, the difficulty of maintaining the price of gas at its present figure will be appreciated." Sometimes it happens that coming events cast their shadows before them. It is on all hands sincerely hoped that the shadows in this instance will not materialize, because in no small degree future expansion of business and greater employment within the industry depends upon maintaining a reasonable price for gas in the present.

Here, however, we have to deal with the past year and its lessons. This is the centenary year of the South Metropolitan Company; and there is gratification on the part of the Board in being able to announce that progress in the demand for gas continues unabated. The increase in the sale of therms was 6·1 p.ct.; the total sale having been 89,203,150 therms—exceeding 1923 by 5,145,844 therms, of which 5,036,721 therms came from private custom, and 109,123 from public lighting. Notwithstanding this expansion of the gas business, the revenue from that source (£2,818,141) showed a decline of £43,092, of which £40,477 was due to a lower receipt from private consumers, and £2615 from public lighting. These facts show that in 1923 the price of gas was reduced to a figure too low to suit the circumstances of 1924—circumstances unforeseen in relation to the secondary products. The increased gas business produced more in the way of rents—the income under this heading (£406,736) showing an advance of £28,725, to which meters contributed £1637, stoves and fires £9033, and fittings £18,055. The increase of the gas business is a matter for hearty congratulation. The reduction of the revenue due to the lowering of the price of gas in 1923 would have been a negligible matter had it not been for the great disappointment in respect of secondary products. The total income from these was £1,244,985—a decline of £53,298. Coke brought in £954,615, or £122,357 more; and breeze, contributing £16,513, gave an additional £2780. But were the figures for the two half years available, we should not be surprised to learn that the increase in the first of the bye-products was due to the good business in the earlier part of the year, and that the second half did much to annul the excellent state of the preceding one. Tar and tar products constituted the worst item, taking the year in its entirety; for throughout there was a steady fall in prices, and the year closed with an income from this quarter less than half what it was in 1923—the receipts having been £168,384, as compared with £339,312 in 1923, or a reduction of £170,928. Ammonia and products also yielded somewhat less—£105,472, as compared with £112,978, or a difference of £7506.

Naturally the increase in business necessitated the carbonization of more coal—58,933 tons; making the total amount carbonized 1,287,739 tons. The cost of this into store (including London Port and tonnage dues) was £1,853,078—an increase of £102,307. The effect of the lower revenue from secondary products is seen in the net cost of coal. Last year it was £608,093, compared with £452,488 in 1923, or an increase of £155,605. This means that the net cost per ton last year was 9s. 5·3d., compared with 7s. 4·3d. in 1923, or 2s. 1d. more. The manufacturing operations were maintained on the excellent scale to which we have become accustomed with this Company. The total make, after deducting 176,259 therms purchased from the Fuel Research Board's Station, was 93,059,613 therms, or 72·26 therms per ton, compared with 72 therms in 1923.

On this occasion there is not much more to be said as to the finances of the half year. Returning to the revenue account, it is seen that the total manufacturing costs were £2,769,057, or £130,141 more than in 1923; and distribution costs £842,173, or an increase of £27,973. There are no other variations on the expenditure side to which special attention need be drawn, with the exception that £39,000 was in 1923 charged to the account for the special purposes fund, but nothing last year. The total expenditure was £4,111,845, or an increase on 1923 of £100,048. The income for the year was £4,474,576, or less than 1923 by £67,920. Adding together the reduction of income and the increase of expenditure, we have £167,968, by which sum the balance carried to net revenue account—£362,731—is less than the amount transferred in 1923. A dividend of 5¾ p.ct. on the ordinary capital (less the interim payment of 2½ p.ct.) is recommended.

Although the outlook for secondary products is gloomy, and may have an effect upon the price of gas, the growth in the popularity of the primary commodity is a matter for considerable satisfaction. These matters and the Bill which has been deposited for obtaining statutory authority to extend the powers already possessed by the Company for association with other undertakings will give Dr. Carpenter some interesting subject-matter for his address to the proprietors to-day. Regarding the Bill, the Directors in their report say that there are "no proposals of the kind at present under discussion." It is a case of looking forward, because "the increasing and economic requirements of gas supply will, at no distant date, render it imperative to make the fullest use of opportunities for associated working." That constitutes one of the articles of our own faith; and that is why we believe, and have done so for years, in the efficacy of the largest possible co-operative effort.

Coke Receipts in 1924.

Annual accounts are proper for the purpose of affording a strictly accurate comparison between one year and another. They have been widely approved in the gas industry. But they deny to the investigator any information which will enable him to locate in respect of time special movements; while the half-

yearly accounts used to bring the inquirer into closer touch with the time of occurrence. There is a case in point in connection with last year's accounts. Taking the whole year, had it not been for coke the total revenue from secondary products would have been very poor; but the assistance rendered by coke is not a fair representation of the position of that commodity the year through. In the first half of the year, demand and price were stimulated by the railway strike; but in the second half-year, there was nothing of an adventitious order to help it. The demand and the price fell; so that in most cases it may be said that the good showing in the annual accounts was largely attributable to the first half of the year. The poorer position of coke continues. And tar, which fell throughout the past year, persists in its weakness in market value. These conditions must have a distinct bearing on the price of gas, on wages, and in not a few cases on rating.

Wembley, 1925.

Bit by bit the picture of the new Wembley is being filled in; and in less than three months the British Empire Exhibition will be again in full swing. Those who exhibited last year and are exhibiting this are using their 1924 experience to improve their displays. Even the Government are doing something to popularize their Pavilion. The housing scheme in the Palace of Engineering is being organized by a Committee of which the Minister of Health (Mr. Neville Chamberlain) is the President. Seven firms have undertaken the responsibilities of the catering; and in this respect ample provision is being made for all classes. We hear of splendid enthusiasm in the gas industry over the plans for a repetition in the Palace of Industry, with new arrangements and features, of the applications of gas.

Tar Distillation Plant.

When crude tar is commanding prices that are unsatisfactory to the producers, the time is particularly appropriate to consider whether better financial results would not be obtained by the use of a distillation plant which yields light oils and dehydrated tar, or light oils, light creosote, and road tar; or even running the tar to pitch and disposing of the tar distillates to a distiller. There is no need for small tar producers to-day to continue under the impression that the advantages to be derived by such primary distillation is not for them. There are various types of plant available for the purpose. Such places as Glastonbury and Aberystwith, where the "T.I.C." plant is in operation, are daily and continuously proving the value of tar treatment at the place of production. We have previously noticed this plant, and the novelty of the process. It was described at a meeting of the London Section of the Society of Chemical Industry last Monday week; and the members were highly interested in it. The principle on which the still operates, it may be recalled, is the rapid transference of heat through the still bottom to the tar by way of a cushion of lead, which enables very large throughputs to be obtained from a small still with continuous operation. The layer of tar undergoing distillation is only about ¼ in. thick; and the tar passes through the still in three minutes. The process is applicable to large as well as to small works.

Concentration and Accidents.

The industrial folk in four towns in South-East Lancashire and North Cheshire—Stalybridge, Hyde, Mossley, and Dukinfield—are not altogether convinced to-day that concentration of electricity generating plant is a good thing. The factories in those towns were considerably inconvenienced and temporarily incapacitated, and thousands of workpeople were rendered idle, by an explosion which occurred at the Tame Valley generating station on Thursday. The explosion was due to the short-circuiting of a cable, which caused an explosion in the main switchgear. In a few minutes the whole of the switchboards were burnt out. This is a case in which concentration of generation spread ill-effects far and wide.

Safeguarding of Industries.

The Government have through a White Paper made known their plans for safeguarding industries. There is to be no Bill; any duties placed on imports after the necessary inquiries have been held will be imposed in a Finance Bill. Before any steps are taken to levy duties—for a limited period—the Board of Trade will have to be satisfied that (1) a *primâ facie* case has been established for the holding of an inquiry, (2) a Committee appointed by the Board have reported that a duty ought to be imposed, and (3) the Board and the Treasury have concurred in the proposal. Among the points upon which satisfaction will have to be given is that the branch of the industry concerned is of substantial importance, that it is subjected to exceptional and unfair competition from abroad, that a serious degree of unemployment is thereby threatened, and that its own operations are conducted with due efficiency and economy. There will be full control by Parliament.

Mr. Frank Hodges Gives Advice.

Mr. Frank Hodges, the former Secretary of the Miners' Federation, is conducting a campaign through the country for the purpose of placing before the miners his views on the critical condition of the coal industry. There are some things he has been saying with which we do not agree; but several of his points embody good counsel for the miners. He agrees that the costs of production at the pits are far too high; and the same applies to the expenses of distribution. Regarding productive efficiency, and in order to secure increased stability, he suggests the following points: (1) Amalgamation into single concerns of all collieries in definite geological areas. The railway system provides for the country a precedent for such amalgamation and unification. (2) The reduction of charges for freight and transport without delay. (3) A new method of coal distribution which would eliminate the onerous charges added to pit charges by middlemen, factors, merchants, and retailers. (4) Power to municipalities to buy coal from the collieries for domestic uses and to embark upon organized retail distribution themselves. Mr. Hodges holds that no person who claims to represent the miners or mine owners can rush blindly into conflict without taking every factor into consideration—indeed, in one of his speeches, he described strikes as "fatuous folly." What he would like to see is four or five years of peace in the coal trade with every responsible mind bent to the task of preparing the industry to hold an important and honourable place among the basic industries of the country, and for that matter of the world. Mr. Hodges has good courage. He is saying what he feels, notwithstanding that this is not to the taste of some of his quondam colleagues.

PERSONAL.

Mr. J. P. HALLAWAY is retiring this month from the post of Gas Engineer to the Municipal Commissioners of Singapore, which he has held for the past 23 years, and is being succeeded by Mr. F. BEDFORD, who was appointed Assistant Gas Engineer in 1922. During the time Mr. Hallaway has been in Singapore, the make of gas has increased from 44 million c.ft. to 272 million c.ft. a year, the number of consumers from 367 to 5064, and the public lamps from 1213 to 2802.

Mr. W. A. WALMSLEY, the Manager of the Chemical Works Department of the Glasgow Gas Committee, has resigned from this position, because of his appointment as Managing Director of Messrs. Thomas Ness, Ltd., of Darlington.

Mr. T. B. ARMITAGE, Assistant Outdoor Superintendent to the Swansea Gas Light Company, on the occasion of his departure for Cheltenham, was the recipient of two very handsome presents, one from the officials and staff, the other from the fittings department. The former took the shape of a canteen of cutlery, which was presented by Mr. W. H. Johns, the Engineer and Manager of the Company; and the latter, a divan chair—Mr. Collins (Foreman Fitter) making the presentation in this case. Both speakers referred to the excellent social and business qualities which had made Mr. Armitage so popular, and, while expressing regret at his departure, wished him success in his new sphere as Chief District Superintendent at Cheltenham. Mr. Armitage, who has been at Swansea for over six years, was the first President of the Wales and Monmouthshire Junior Gas Association, and was previously for over four years with the Aldershot Gas and Water Company.

Mr. G. E. H. KEILLOR has resigned his position as Chemist in the Blackburn Gas Department, upon his removal to Dunfermline.

Consequent on the resignation of Mr. R. F. Stewart, Research Chemist, and the promotion of Mr. C. Chapman from Assistant Works Manager to Works Manager at the Provan Chemical Works, Mr. T. A. WILSON, F.I.C., A.R.T.C., has been appointed Research Chemist, and Mr. ROBERT G. W. EADIE, B.Sc., Assistant Works Manager.

At a meeting of the Institution of Civil Engineers on the 3rd inst., Mr. JOHN GRICE TOOMS, Gas-Works, Oslo, Norway, was elected a member.

We understand that Mr. C. VALON BENNETT, of Rochester, was admitted to the Freedom and Livery of the Worshipful Company of Paviors on Thursday last, the 4th inst.

Dr. G. E. FOXWELL has resigned the office he held in the Gas Light & Coke Company, in order to return to the Koppers Coke-Oven Company as Chief Chemist and Physicist.

Many friends in the gas industry will be pleased to learn that Mr. R. J. GOODYEAR (the Export Representative of Lighting Trades, Ltd.) is making satisfactory progress at a London nursing home following a recent operation.

OBITUARY.

We are sorry to learn of the death of Mr. C. H. WORDINGHAM, who, though a Consulting Electrical Engineer, had been identified with Parliamentary and other inquiries connected with the gas industry. For a good many years he was Electrical Engineer-in-Chief to the Admiralty, and he was President of the Institution of Electrical Engineers in 1917 and 1918. In addition, he was a member of the Institute of Metals, a member of the British Engineering Standards Committee, and one of the British representatives on the International Electro-technical Commission.

ELECTRICITY SUPPLY MEMORANDA.

IN the newspapers there is much foreshadowing of the intentions of the Government in respect of plans for developing the availability of electricity in this country. "The Times" positively says that one of the most important matters that will be dealt with by the new Parliament will be electrical development. This comes within the purview of the Ministry of Transport, to which the Electricity Commissioners are a pendent body. A Departmental Committee have been considering the plans which were outlined by Mr. Snowden on behalf of the Labour Government last year. According to our morning contemporary, the Committee have completed the task, and their report will be available shortly. It is hoped that the Government will be in a position to introduce a more or less agreed Bill on the lines of the report, although this may not be possible until quite late in the session. The "hope" suggests that there may be some truth in the statement to which we referred last week—that the Government, before doing anything definite, intend to take counsel with prominent men connected with existing electricity undertakings. The sapient statement is made that "it is held that, if a non-contentious measure can be brought forward, its passage into law should not be long delayed." But the same thing has been said many times before in regard to Electricity Bills; and each time a measure has seen the light of day, and its terms have been digested, hostility both from within and outside the industry has risen with mighty force. It may be so again. When the Bill was originally introduced from which the 1919 Act was constructed, the antagonism was immense; and if there is any idea of reviving the scheme of compulsory powers to the Electricity Commissioners—"The Times" appears to indicate that there is—then it is pretty safe to say that there will be a large amount of resistance in the electricity industry to giving up an independent existence and being compelled to enter into the Commissioners' co-ordinating schemes. It is admitted freely that the voluntary basis of the Act of 1919 has not enabled the co-ordinating schemes for electricity generation to be carried far.

To Develop Electricity Availability.

In the same article, this statement appears: "The fear has been expressed by gas undertakings that an extended development of electric power might mean that gas would become altogether a thing of the past. It is stated that this is a misapprehension. Electricity is not intended to compete with gas, but to co-operate with it; and it might well be that, in the future, gas will be extensively used in the generation of electrical power." The misapprehension is not on the part of gas undertakings; it lies with those who think the gas industry is chargeable with any such absurdity as that stated in the first part of the foregoing quotation. There is no responsible gas man, with an ordinary share of intelligence, who thinks that the development of electric power might mean that gas would become altogether a thing of the past. There are very good economic and technical reasons for knowing that electricity cannot annihilate the gas industry; and those reasons have such resisting force that, even where electricity is cheap (as electricity goes), the gas undertakings are making unprecedented progress on the primary side of their business. The objections of the gas industry are not based on fear of becoming defunct, but on the preferential treatment of one industry by State-aid. The gas industry has developed in its public services unaided by subsidies from the national purse; and so long as the electricity industry develops from its own resources, and meets its own financial obligations, and, where the undertakings are controlled by local authorities, without dipping into the rates for support, gas undertakings cannot have any legitimate ground of complaint. In those circumstances, it would be up to the gas industry to meet fairly and squarely any competition from its trading rival. It is something new to learn from "The Times" that electricity is not intended to compete with gas, but to co-operate with it. The co-operation is practically *nil;* the competition is keenly carried on. There ought to be more co-operation. That is slowly making way by the gas industry supplying fuel to the electricity industry; in the future it may generate and supply electrical energy to its competitors. What should be insisted upon is that the Government should, before indulging in more legislation for the development of electricity, do what was suggested in the first editorial article in last week's issue—make a thorough exploration by a representative and competent body of the whole problem of fuel, power, and heat supply. It is a national question, and should be dealt with not in sections, but as one great inter-related problem.

The "Fear" of the Gas Industry.

We do not for one moment suppose that our good friend Colonel the Right Hon. Wilfred Ashley, Minister of Transport, knows much regarding the technicalities of electricity generation, or its limitations in the realms of economy and efficiency. Someone has been priming him very much from the electrical point of view. The other day he opened a small electricity station at Ringwood, Hants. In the course of his speech, he asserted that no country had more favourable features than this one for the production of electricity. That is strange. The experts have been complaining of the fact that it has not the same favourable features as other countries. If it stands in that pre-eminent position for the production of electricity, our experts have been extraordinarily lax in not making use of them. Perhaps there is some amount of truth in this—there must be if the Electricity Commissioners and their co-ordinating schemes as planned on paper are really necessary to our electrical well-being. He also says that the cost of transmission is not a matter of great moment. It is clear that he has not studied an analysis of electricity costs, which show that transmission is not a negligible element in them. He sees no reasons why new districts should not be opened up, and villages given the advantages and amenities of electricity at a very much lower price than is possible under existing conditions. It would have been of extreme interest had he given the reasons why he thinks it is feasible to supply these areas, on a sound commercial basis, at a lower price than is at present possible. He hopes that cheap power will be provided for industry and traction, and in due course for heating and cooking and domestic service generally. The "Evening News" fastened on to the speech, and in an editorial article made use of platitudes and postulation. It says the greater the supply of electricity, the smaller the cost. That depends upon the circumstances. It may be that in certain circumstances greater transmission costs may wipe out any advantages of centralized generation. Then our contemporary says: "What a different London it would be if all the household fires were electric, and all the factories ceased to burn coal, having a cheap and abundant supply of electric power!" True. But has that paper investigated the cost to the domestic consumer of using electricity (possessing per KW.-H. 3420 B.Th.U.) for all heating and cooking, and factories for all their heat requirements. Some of our newspaper writers require a vast amount of educating in these matters. Yet there is wisdom when the "Evening News" asks whether, in "the age of electricity," people will not find perfection itself a bore, and will they be any happier. They would not only find it a bore, but they would find that electricity, like other mundane things, is imperfect, and in addition is uncomfortably expensive. A further prediction of our contemporary is that, when our descendants tire of electricity, they will go back to coal fires as an improvement on electric stoves. Our view is that very few people who have adopted and will adopt gas for heating purposes will go to the more expensive agent electricity, and they will not forsake the conveniences of gas to return to coal. It is easy to predict what may take place; but to order fulfilment is not the prerogative of the prophets. Fulfilment or the contrary is a matter that rests in the hands of those who have to pay.

When We are All Electrified.

Light Castings Prices.—The National Light Castings Association have advanced the prices of all cast-iron goods as from the 9th inst.—the advance varying on different classes of goods from 2½ to 10 p.ct.

Manchester Smoke Abatement Conference.—The large number of valuable papers, &c., which were submitted at the conference held, under the auspices of the Smoke Abatement League of Great Britain, in Manchester last November (together with reports of the discussions thereon) are being arranged in a bound volume, and in this convenient form will very shortly be available. The Hon. Secretary of the League, Mr. C. Elliott, B.Sc., Assoc.M.Inst.C.E., of No. 33, Blackfriars Street, Manchester (to whom orders should be sent), intimates that the price of the volume will be 5s., or post free 5s. 6d.

COMMERCIAL GAS COMPANY'S POPLAR SHOWROOM.

The "Good Ship Enterprise."

WHAT may be described as a new departure in the policy of the Commercial Gas Company was inaugurated last Thursday by the opening of extensive showrooms, replete with the most attractive and most efficient appliances for the utilization of gas, in the very heart of the Company's industrial area—that is to say, in the East India Dock Road, Poplar. As Mr. H. E. Jones (the Deputy-Chairman of the Company) so aptly put it, when presiding at the opening ceremony, the Company have now launched, in the middle of the dock area of London, "a ship which might well be called the 'New Venture' or the 'Enterprise;'" and to this we would add that there can be little doubt that, under the captaincy of Mr. L. F. Tooth, M.B.E. (Chief of the Company's Gas Sales Department), the ship will return them a rich and overflowing cargo in the shape of new business.

There had been pleasurable anticipation on the part of the guests who assembled on Thursday, at the invitation of the Chairman and Directors of the Commercial Gas Company, to enjoy a private view of the new showrooms, situate at Nos. 281 and 285, East India Dock Road, Poplar, E., the freehold of which premises has been acquired by the Company. The majority of the visitors at any rate well knew what a thing of beauty a modern gas showroom can be made; and accordingly their expectations ran high. Let it be said at once that they were in no sense disappointed; for the hand of the expert is to be recognized throughout the scheme. The task of the Architect has been a responsible one; but in this capacity Mr. Victor Wilkins (who had previously designed two showrooms for the South Metropolitan Gas Company, as well as the one recently opened at Portsmouth) has discharged excellently his duties of adaptation and arrangement. As for Mr. L. F. Tooth (who was appointed Chief of the Gas Sales Department of the Company in March, 1923), he has been able to bring to bear upon the choice of goods with which to equip the showrooms an experience of the particular requirements of the Company's consumers extending over a great number of years, together with his extensive knowledge of gas-consuming apparatus in general.

THE OPENING.

On arrival, the guests proceeded to the first floor, where they were, in the regretted unavoidable absence of the Chairman of the Company (Mr. W. G. Bradshaw, C.B.E.), received by Mr. H. E. Jones, in his capacity as Deputy-Chairman. At tea—during which there were also present Mr. Stanley H. Jones (the Engineer and General Manager), Mr. F. J. Bradfield (the Secretary), Mr. Tooth, and Mr. Wilkins—Mr. Jones was an admirable host, delighting his hearers with his reminiscences, and with the generous tribute he paid to Mr. Tooth's work. "There is," said Mr. Jones, going right to the root of the whole question, "a necessity for what Mr. Tooth has carried out here, with all its magnificent surroundings; for it is the fashion now to show people how to burn gas. If you show them how to burn it so as to enjoy its benefits to the utmost, they will probably buy it off you. At one time gas people did not realize that it was not so simple to burn gas properly that they could afford to neglect this aspect of the matter altogether." Alluding to Mr. Tooth, Mr. Jones said that "he is a live wire; he is very active and full of energy. The Company's gas is used for melting the gold and silver at the Mint; and Messrs. Rothschild also treat precious metals in gas furnaces—many of them Mr. Tooth's own invention." Mr. Jones also complimented the Architect, who, he said, "I think you will agree, has made a very good job of it."

The outside Sugg lamps were later turned on by Mr. Jones by means of distance controls; and for the remainder of the evening the 140 ft. width of window space—one-half of which is in East India Dock Road, and the other half in St. Leonard's Road—proved a source of irresistible attraction to passers by, who were able to admire a display, well illuminated by good lights, such as many of them had doubtless never seen before of the latest types of gas fires, cookers, restaurant utensils, furnaces for industrial work, and appliances for domestic, shop, and factory lighting. The brightness of the display is added to by various gas-actuated flashing devices—among them being a new design fitted to the side entrance fanlight, by the Klydo Company, of Belvedere Road, S.E. Attention will also be attracted by a working model demonstrating the action of the Radiation "Injector-Ventilator."

IN THE BASEMENT.

All that has just been referred to can be seen from the outside; but it is, of course, no more than a very small part of the whole. With curiosity whetted, the consumer or prospective customer will step inside, and he (or she) will soon be convinced of the truth of the slogan: "You can do it better by gas."

Beginning at the bottom, let us take the basement. Here is to be found an excellent assortment of Fletcher-Russell hotel, canteen, and restaurant equipment, hot-water apparatus, and furnace burners and furnaces, many of them patented by Mr. Tooth, of various types and for different purposes. Included are furnaces for laboratory work, bar-bending furnaces, open hearth furnaces, melting furnaces, and a tilting furnace for the treatment of brass, copper, or other metals, up to 600 lbs. capacity. All received their meed of attention last Thursday; but work actually in progress naturally proved the centre of attraction.

METAL CUTTING BY OXY-COAL GAS.

Mr. H. Brittain, of Messrs. Hancock & Co., Ltd., Aurelia Road, Croydon, superintended a demonstration of metal cutting by oxy-coal gas. The Hancock oxy-coal gas cutting and profiling machine (which readers will recall having seen at work in the Gas Exhibit at the British Empire Exhibition last year) has been placed on the market with the object of putting all classes of engineers and metal workers in a position to cut up metal plates, bars, angles, tees, channels, girder sections, &c., at the smallest possible initial outlay, with minimum running costs and upkeep. It is made in various designs to meet the requirements of the different branches of the iron and steel trades. Further, it is self-contained, and is independent of main-line shafting, pulleys, countershafting, or belts; and its only power is a very small motor (driven electrically or by clockwork) attached to the head. On behalf of this machine, it is claimed that the oxy-coal gas flame has a low temperature combustion; and if the proportions of coal gas and oxygen are correctly mixed, as is the case here, the entire carbon constituent is oxidized, leaving the metal in an unaltered condition after cutting. The cut really is not due entirely to the heat factor, but to "heat harnessed in such a way as to set-up harmonic vibration; and suitable metal subjected to this process is parted at the cut more by blowing away the granular construction than by burning."

With the Hancock machine, it is only necessary to use the oxygen under pressure; the coal gas can be taken from the supply pipes at normal pressure. The device lends itself in various ways to reducing cost of production. First, because it can be operated by semi-skilled or unskilled labour; secondly, its rapid-cutting properties reduce the manufacturing times to a minimum; and thirdly, the cost of the gases and wear and tear are negligible. The process is used on various types of patented machines to cover a very wide field.

BIG INDUSTRIAL POSSIBILITIES AND REALIZATION.

Another demonstration was witnessed on the first floor, where there is a room conveniently arranged for showing the application of gas to cookery or trade purposes, as well as for lectures. Under the able direction of Mr. A. H. Hopkins, who has had a life-long connection with pottery working, the visitors were able to see pottery spinning with a hand-turning wheel, together with glazing and firing by gas. Plates were signed, and it was thoughtfully arranged that these should be fired later and forwarded to the respective signatories as mementoes. They will represent Old Bow China—the factory for which, as a matter of fact, stood practically on the site of the showrooms.

In this room also is displayed a comprehensive selection of other articles manufactured by the aid of gas, together with a number of excellent photographs of industrial gas installations and trade appliances. Among different branches of industry represented are refractory materials, die casting, case hardening, enamelling, tempering, varnish boiling, oil blending, and glass enamelling. Much admired were some very fine specimens of enamelling on copper and silver; and other of the less usual processes depicted are the polishing of glass tumblers and vitrified labelling of glass for medicinal purposes and chemistry work. Mention should also be made of coffee and pea nut roasting.

The Commercial Gas Company are fortunate in possessing an area within which exist great possibilities for the industrial utilization of gas; and these possibilities have been, and are still being, untiringly followed up. The result is that the Company are able to point with pride to a number of very large consumptions. Reference has already been made to Mr. Jones's remarks regarding the extensive use of gas for precious metal melting and refining; also to its employment in the polishing of ordinary glass tumblers, by the Canning Town Glass Works (a branch of British Glass Industries), who are very big consumers. Samples of first-rate biscuits, it was gathered, had been baked in ovens 80 ft. long by Messrs. Sanders Bros., of Limehouse, whose consumption of gas may be taken as about 20 million c.ft. a year. Extensive sugar boiling by gas results in the production of toothsome delicacies by Messrs.

Batger and Keiller, of Ratcliffe and Silvertown. Another interesting display is of roofing felts, different classes of asphalt damp-courses, &c., entirely manufactured by gas, by Permanite, Ltd., of Old Ford, who are, it is stated, the only people who use gas for this purpose—which they do exclusively, making them consumers to the extent of 9 million c.ft. a year.

FOR THE DOMESTIC CONSUMER.

The body of the ground floor showroom is rightly given over to a display of choice gas pendants, brackets, ventilating lights, table lights, bronze figures, &c. No method of artificial lighting could be provided with more handsome or more decorative fittings and shades than are to be found here and on the first floor. Most of the lighting points have attached to them pneumatic switches or distant control devices. Cookers, fires, radiators, gas irons, and other appliances of domestic utility, are also to be found on this floor, which has attached to it a model kitchen and a model bathroom. The Company's Roll of Honour is placed in a little recess, flanked with Sugg "Flambeaux" lights, similar to those at the entrance to the Gas Exhibit at Wembley. In addition to lighting fittings, further cookers and fires are arranged around the first-floor showroom, which includes a well-appointed model dining room. A "Newell" light for the stairs is controlled by pneumatic switches fitted at the bottom and the top of the staircase.

The furnishings—always an important item in connection with an enterprise of this character—have been provided by Messrs. T. Venables & Sons, an old-established firm of High Street, Whitechapel, who have done excellently the work entrusted to them.

SCOTTISH JUNIOR GAS ASSOCIATION.
(WESTERN DISTRICT.)

On Saturday, Jan. 31, 120 members of the Western Juniors paid a visit to the Meter Works of Messrs. Alder & Mackay, Ltd., Stewart Terrace, Edinburgh.

Mr. J. L. BENNETT, who welcomed the visitors on behalf of his firm, said that since the last visit of the Association, five years ago, the New Grange Works had been reconstructed, and everything brought up to date during this time. No less than 10,000 sq. ft. of floor space had been added, and a complete heating system with 1½ miles of pipes installed.

INSPECTION OF THE WORKS.

The visitors were conducted in parties by members of the staff, and followed with interest the manufacture of gas meters from start to finish; the foremen in the various departments giving demonstrations of the respective operations.

In passing through the various departments, the visitors were greatly interested in the specially constructed machines and tools for the many parts of the meter, particularly the presses for stamping work, the vertical drilling machines, and the hand-press moulding machines. The various assembly shops were visited, and meters shown in every stage of construction. The "Aerostyle" painting machines attracted considerable attention, and the pressure-wave controllers for street lighting were examined. The many improvements were appreciated by those who visited the works in 1919. Everyone was impressed by the lay-out and cleanliness of each department, and the good natural lighting throughout the building.

Apart from ordinary meters, which form the bulk of the output of these works, the Company make cast-iron cased dry meters; Green's underground wet meters for outdoor purposes; the "A. & M." pressure-wave controller for public lighting; hurricane-proof copper street lanterns; wet and dry test meters; and complete testing plant, embodying standard holders.

A feature of singular interest was a cast-iron dry meter which had been buried and lost for nineteen years under mud and water, and which, when reclaimed, was only 3 p.ct. slow—a striking argument in favour of the cast-iron type of dry meter.

After the inspection of the works the party were entertained at tea.

Mr. J. L. BENNETT, who presided, understood that at this visit there was a record attendance; and Messrs. Alder & Mackay took it as a great compliment to the firm. At the New Grange Works the average weekly output was 1000 meters.

Mr. JOHN M'ISAAC, President of the Association, thanked Mr. Bennett for his cordial welcome, and asked him to convey to the Directors the thanks of the Association for the privilege of visiting their works, and for their generous hospitality. Mr. M'Isaac complimented the staff of Messrs. Alder & Mackay on the courteous manner in which they had explained matters to the visitors.

Thereafter an informal musical evening was spent, many of the members showing considerable talent.

At the last monthly meeting of the South Metropolitan Gas Company Co-Partnership Committee, the Chairman (Dr. Charles Carpenter) announced that the Executors of Mr. Kenneth P. Hawksley, a former Director, had notified him of a bequest of £250, to be appropriated for the benefit of the employees of the Company or their widows and orphans.

THE "JOURNAL" DIARY AND GAS CALENDAR, 1925.*

Reviewed by Prof. John W. Cobb.

This little book, issued from the Offices of the "GAS JOURNAL," and written and compiled by Dr. W. B. Davidson, is one which gathers together a large amount of useful information in a small compass. It consists, in the first place, of a diary, and that is followed by what is called the "Gas Calendar" of 1925. The latter is arranged on the principle of an encyclopædia or dictionary, subjects being named and treated in alphabetical order. Ease of reference is so facilitated, although continuity of treatment is necessarily lost. This does not matter very much, perhaps, for a production in which extreme condensation is the primary essential.

The form adopted allows the inclusion under "G" of a list of Gas Undertakings. For this the C.V. declared and supplied, the gas made per annum in c.ft. and therms, and the name of the engineer or manager are given. There follows an interesting page entitled "History and Statistics," in which the first entry is "1600—Van Helmont observed that coal when heated 'did belch forth a wild spirit or breath,'" and the last "1920. Gas Regulation Act." Any history made since then is not recorded.

Dr. Davidson's long connection in the past with the Gas Department of the Birmingham Corporation established his reputation as a Gas Chemist, and there is an admirable solidity in the general technical and scientific information bearing on the gas industry which he has succeeded in compressing into the 90 pages of closely printed matter which constitute the chief and characteristic portion of the work. The contents of many text books, dictionaries, books of tables, and Dr. Davidson's own experience have been drawn upon for the mass of detail which it contains. Taking at random some of the headings, one finds "Gas Act," "Condensation," "Benzol Recovery," "Constituents of Coal Gas," "Meters," "Thermal Efficiencies," "Water Gas," treated in turn. (As a mere matter of detail, the spelling of "benzole" with a terminal *e* is now usually preferred for the commercial product.)

Although the reviewer cannot claim to have given careful reading to all, or most, of the paragraphs into which the book is divided, he has consulted it under a number of headings, and is convinced of its real usefulness. At times there is a tendency, in a desire to be sufficiently inclusive without taking up too much space, to treat a subject so briefly that it might perhaps just as well not have been mentioned at all. Again, under what the author terms "Active Coal," it is advisable to make clearer that, as regards active carbon and silica gel, there is something to be said on both sides. In this matter, as in the remarks made on the efficiency of lighting under the heading "Illumination," it would have been possible on the strength of information already published to be more informing. No one questions the importance of flame temperature as a factor in the determination of lighting efficiency, but no one who knows the facts is prepared to leave it there. These are, however, only minor blemishes in an excellent work.

There are some subjects noticed which lie off the track of the gas engineer's routine, but are not at all remote from the gas industry, and among these I may mention "Petroleum Refining," a process excellently and simply summarized by the use of a table. "Refractory Materials" receive some attention, and quite suitably in this case the revised specification of the Refractory Materials Committee of the Institution of Gas Engineers for retort materials, fire bricks, silica bricks, &c., constitutes the principal part of the matter included.

Under "Water Gas," Dr. Davidson finds room for a table giving "Harries' classic results." The reviewer is not surprised at this. Everybody quotes them, although it would be difficult to find a set of experiments concerning which the information necessary for their proper evaluation is so meagre. And so one might proceed. All sorts of interesting points crop up in looking into a book of this kind.

Summarizing, it is a really excellent little handbook. The binding is handsome, but the print is rather small for any but young eyes. Presumably this has been held necessary for keeping down its size; but the reviewer feels that compression has gone rather too far in this respect—particularly since he is convinced that the book is one which will be much consulted both inside and outside the profession of gas engineering. A word as to the future. A serious and successful attempt has been made in this handbook to bring the information contained in its tables and text up to date. If in future editions it is kept in this condition by systematic and adequate revision, a common shortcoming in such productions will be avoided.

* "The 'JOURNAL' Diary and Gas Calendar, 1925," by Dr. W. B. Davidson. London: Walter King, Ltd. Price, 7s. 6d. post free.

Mr. John Murphy, a well-known Irish shipowner, and the Chairman of the Alliance and Dublin Consumers' Gas Company, who died last October, at the age of 83, left personal property in England and the Irish Free State valued at £173,851.

GAS WORKERS' WAGES.

The Respective Claims and a Deadlock.

IN our editorial columns to-day, an article gives further information as to the dispute that has arisen in the gas industry regarding the wages of gas workers. The following notes will be read with interest in conjunction with that article :

CLAIMS OF THE UNIONS.

(1) An increase in wages of 12s. per week.

(2) Time-and-a-quarter for all night-shift work.

(3) Extension of holidays to fourteen days per annum.

CLAIMS OF THE FEDERATION OF GAS EMPLOYERS.

That the wages of gas-workers should be regulated upwards or downwards by a sliding-scale, based on the average cost-of-living figures, over the usual three-monthly periods in a manner similar to that which has been in operation previously, but with this difference : That the slide should be ½d. per hour for every six points, and should operate automatically without the existence of any neutral zone.

STATEMENT TO THE PRESS.

On Wednesday evening of last week, the following statement was issued to the Press :

It is probably well known that for the last three years wages in the gas industry have been regulated upwards and downwards by a sliding-scale based on the cost of living figures.

At the end of last year, both employers and workers gave three months' notice to terminate the sliding-scale agreement—the workers upon the ground that the same was not sufficiently favourable to them, inasmuch as they demanded (among other things) an increase in wages; and the employers upon the ground that the sliding-scale agreement was onerous to them, particularly having regard to the very serious slump in coke and the residual bye-products of the industry which is now being experienced throughout the country.

The employers offered arbitration on the whole dispute, including not only the claim of the workers' side, but that of the employers that the sliding-scale should be modified in their favour. The workers' side of the Industrial Council refused to accept arbitration on these terms. The workers' side endeavoured to limit the terms of reference to their own claim, although the employers' side clearly indicated to them last December that the sliding-scale needed rectification.

The position of the industry is such as would clearly warrant a reduction in wages; but the employers are prepared to forego any claim for a reduction at the present moment provided that the sliding-scale is modified.

MR. HAYDAY'S EXPLANATIONS AND VIEWS.

Mr. Arthur Hayday, M.P., the Vice-President of the General and Municipal Workers' Union, has made various communications to the Press regarding the matters in dispute and the trend of events.

On Thursday, " The Times " stated : The employers' representatives and the men's leaders met in London yesterday to consider the dispute. Mr. Hayday, one of the men's leaders, afterwards said :

The negotiations were connected with our application of June last for a 2s. per day or shift increase, with time-and-a-quarter rate for night-shift men, and an annual holiday of two weeks with pay. Between 70,000 and 80,000 men are involved. When we met the employers to-day, they suggested that we should agree to the terms of reference including not only our own petition, but a counter scheme, which we heard for the first time to-day, providing for a ½d. an hour increase or decrease for every variation of six points in the published cost of living figures. We, as representing the workers, could not accept the new matter introduced by the employers. We are prepared to recommend arbitration upon the petition we submitted if the employers will concur. We are quite willing to discuss with the employers the question of a new agreement after the subject of our petition is settled. The position at the moment is fraught with serious possibilities. We are at a deadlock. We parted to-day without any arrangements having been made for any further meetings; and it will be very serious if a settlement is not arrived at before the end of March, when the notices expire. The membership of the Unions concerned is definitely against the sliding-scale.

In the same contemporary on Friday, the following appeared :

Mr. Hayday said yesterday that there was a complete deadlock; but they believed that the strike weapon should only be resorted to when all other methods had failed. The men generally were discontented. They saw themselves losing ground in comparison with other workers; and taking into account the strenuous nature of their work, the present wages were comparatively low Unless an improvement could be secured, the pressure from the rank-and-file might be too great. There were already disturbing indications of discontent leading to unofficial action. Dealing with the ability of the industry to meet the increased wages asked for, Mr. Hayday said that the average increase in the cost of gas to the consumer was only 50 p.ct. above the pre-war price; and their information was that in some cases the increase was only 36 p.ct. If all commodities had increased only 50 p.ct. on pre-war charges, there would not be much to grumble about.

A meeting of the executives of the four unions which are parties to the dispute is to be held to consider a general policy for united action.

The Governor of the Gas Light and Coke Company dealt with the dispute in the course of his address to the proprietors last Friday. The report will be found in our news columns.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Visit to Beckton.

The Association were favoured by excellent weather on the occasion of their visit to the Beckton Works of the Gas Light and Coke Company on Saturday, Feb. 7; but it was not the weather only which accounted for the remarkably good attendance at this meeting, for the word Beckton always has spelt and always will spell interest and enjoyment to gas engineers. There is invariably something new to see; and so each visit holds fresh interest and proves of great educational value.

The Association were greeted at the main entrance to the works by Mr. W. B. Leech, the Station Engineer, and were divided into two parties, each with a distinctive route to follow. The guides of the first party, conducted by Mr. Leech, which inspected the filtration plant and No. 1 pier, where interesting constructional work is at present being carried out, were Messrs. Hay, Birks, Hunter, Lamond, and Rose; while those for the second party, conducted by Mr. E. J. Hutchence, which visited the magnetic separator and the oxide handling plant, were Messrs. Richmond, Wallington, Anderson, Edwards, and Trewby. Both groups saw the oil gas plant, No. 6 retort house, and the mechanical workshop.

WATER FILTRATION PLANT.

All were impressed by the excellent engineering work embodied in this plant, which is designed to deal with 4 million gallons of Thames water per day. The sedimentation of the suspended matter is assisted by the addition of lime, which has the effect of coagulating the floating particles and causing them to fall more rapidly. Very little lime is required for this; only 1 grain per gallon being necessary. The fine impurities are removed by sand filters; the time for sedimentation at full load being about 3½ hours. The water is delivered to the plant through two 12-in. mains by electrically driven pumps—two pumps of 70 H.P. have a capacity of 2 million gallons per day, and two pumps of 35 H.P. are capable of delivering 1 million gallons per day. Clean water is pumped into the works main at 70 lbs. pressure. This rapid filtration plant is without doubt one of the largest installations yet put down for purifying tidal river water for general industrial use, and was designed and constructed by the United Water Softeners, Ltd., of London. It is of interest to note that the filtered water is used throughout the works for all purposes excepting boiler feed and drinking water.

A STUPENDOUS ENTERPRISE.

The new coal handling plant in course of construction consists of eight travelling electric luffing jib cranes, disposed four on each arm of No. 1 pier. These will grab the coal from the ships moored alongside, and deliver into travelling hoppers feeding the coal on to 48-in. belt conveyors. The pier belt conveyors will carry the coal towards the pier head, where it will be transferred through shoots either into barges under the pier, or on to a 54-in. conveyor leading towards the shore. Here another 54-in. belt will receive the coal and carry it off at right angles on to the 54-in. conveyor over a 6000-ton capacity reinforced concrete hopper under construction. In order to carry the cranes, it has been found necessary to construct an entirely new gantry supported on cylinders sunk through the strata of the river bed into the chalk. These cylinders are 10 ft. in diameter for the bottom 19 ft. 6 in., which is made up of three sections of steel cylinder. On the top of this steel portion a cast-iron reducing cone is bolted, reducing the diameter from 10 ft. to 6 ft., and above this cone the columns will be 6 ft. in diameter, to match the existing columns.

The cylinders are sunk a minimum of 5 ft. into the chalk; and the minimum founding level of the cutting edge is 47 ft. below high-water level. To give weight to assist in the sinking of the cylinders under compressed air, a ring of concrete has been constructed inside the cylinder round a shaft 3 ft. in diameter, widening out to form the working chamber at the cutting edge, from which the material is removed by skips hauled up and down through the 3 ft. diameter shaft and through air locks above. After the cylinder is sunk to the required level, the shaft and working chambers are filled solid with mass concrete. A test load of 600 tons is then stacked on to the top, which results in a test pressure on the chalk of approximately 0½ tons per sq. ft. The columns will then be completed to the required height, and the girders carrying the crane track will be erected on top. The front girders weigh about 24 tons, and the back girders about 17 tons each. The cranes, which weigh about 120 tons each, have a maximum radius of 55 ft., and

each of the grabs weighs 3½ tons, and has a capacity of 3¾ tons. The pier arm conveyors have a capacity of 1000 tons per hour, the shore and hopper conveyors 2000 tons per hour, while the hopper, which will serve six lines of wagon track, will be capable of storing 6000 tons of coal.

MAGNETIC SEPARATOR.

A full account of this efficient plant was given in the "JOURNAL" for July 23, 1924, p. 387, when it was mentioned that an important advantage of magnetic separation lies in the fact that coke and coal particles are recovered in a dry state. The plant as a whole is small, simple, and unaffected by climatic conditions. In this plant, which is an experimental one of a capacity of 1 ton per hour, there is one magnetic drum having two fields. The ashes are uniformly led to the drum by a shaking tray or screen. On the drum the clinker is attracted by powerful magnets, and adheres until, after half a revolution, on passing out of the magnetic field, it drops away. The coke particles, not being attracted, are thrown off before this stage. The working expenses of this plant are small; the electric power required for the magnets amounting to about 0·8 to 1 KW. per ton of ashes, while the power required for driving the separator, including the shaking feeder, is only about 1½ H.P. The running costs average 6d. per hour.

OXIDE HANDLING PLANT.

Some idea of the size of this plant will be gained when it is stated that its capacity is 40 tons per hour. Side-tipping wagons containing the oxide are brought into the plant, and the oxide is tipped into a breaker. From here it passes to a disintegrator and thence to a hopper, from which it is taken to store, or placed into wagons for immediate use, by an electric crane, the grab of which has a capacity of 2 tons. The longitudinal travel of this crane is from 300 to 350 ft. per minute, while the cross travel and hoisting speed are respectively 150 ft. and 50 ft. per minute. The current required, of course, varies according to the percentage of moisture in the material; but an average figure of 1·3 units per ton of material prepared and loaded may be taken. Four men only are required to work the plant. Taking 300 tons per day, the cost of preparing and loading is 1·7d. per ton, and the cost of current 1·3d. per ton.

CARBURETTED WATER GAS PLANT.

This plant has a capacity of 27 million c.ft. per day, and is comprised of seven carburetting sets fitted with five waste-heat boilers, and two blue sets complete with boilers. The air blast is supplied by De Laval steam turbines of 110 H.P., each driving Rateau fans at 2000 R.P.M. The waste-heat boilers evaporate 6000 lbs. per hour. An addition to this plant is a remarkable coke hoist, which is 93 ft. 6 in. in height. Wagons are hoisted to the top of the water gas house, where they are tipped on to a cross conveyor belt 120 ft. in length. This feeds on to a shuttle conveyor 330 ft. long which communicates with the coke hoppers for the several water gas sets. Fifteen trucks can be dealt with in an hour—equivalent to over 100 tons of coke—and only three men are required for working the hoist.

NO. 6 RETORT HOUSE.

This house, which contains nine settings of ten retorts, has been completely reconstructed. The settings are of the Drake's regenerative type, and the retorts are constructed of Stein's 95 p.ct. silica material. The average combustion temperature is 1400° C., and the weight and duration of the charge 17 cwt. and 12 hours respectively. The daily make averages 5¾ million c.ft., equivalent to 32,000 therms, The capacity of the overhead storage bunkers is 1000 tons, and that of the stage bunkers 750 tons. A special coke handling plant, having a rubber belt shuttle conveyor, is installed in this house. With this Mr. Leech expressed himself as thoroughly satisfied.

After inspecting the workshops, the parties met together at tea in the works canteen. Thereafter,

Mr. W. L. WESTBROOK, Vice-President of the Association, said that Mr. Newton Booth, their President, was suffering from influenza, and consequently had been unable to attend what had proved to be a highly interesting visit. The Association had been honoured that afternoon by the presence of Mr. Leech; and their thanks were certainly due to him and to the Company. He (the speaker) had been particularly impressed by the water filtration plant, which, he had been informed, had worked for nearly two years without giving any trouble. Again, the work in connection with the new coal handling scheme constituted an example of fine engineering. He would call on Mr. Frost, of the South Metropolitan Gas Company, to propose a vote of thanks to the Directors of the Gas Light and Coke Company and to Mr. Leech.

Mr. F. A. FROST said how very much the Association were indebted to the Company for the splendid facilities afforded. The extent of their appreciation of a visit to Beckton, which had so much of interest for any gas engineer, was manifest by the large attendance. The Beckton Works of the Gas Light and Coke Company impressed one with the magnitude of the gas industry, and enabled one to see not only efficient methods of carbonization and gas manufacture, but also excellent examples of constructional work. During the last twenty or twenty-five years, no works had installed more labour-saving plant than had Beckton. The visit had been replete with interest; and he had great pleasure in proposing a vote of thanks to the Company, to Mr. Leech, and to the guides, for an enjoyable afternoon.

Mr. D. CLEAVE CROSS, who seconded the vote, remarked upon the fact that on every visit to Beckton there was always something new to see and something fresh to learn. The efficiency of the works was an indication of good organization, without which a close watch could not be kept, in a works of the size of Beckton, on the many phases of gas manufacture.

Mr. LEECH, replying on behalf of the Directors of the Company, said it was always a pleasure to have the Association with them; and it was particularly gratifying, and showed with what keenness the Association regarded their work, to see such a large attendance. Once before he had mentioned the benefits which accrued from these visits—benefits which could be divided into two classes, positive and negative. They enabled one to learn things which could be applied with advantage, and to see things which should be avoided. He certainly hoped that their visit to Beckton had been of service. Reference had been made to the organization of such a large station. This was undoubtedly a great problem; and he was glad to say that at Beckton they had a most efficient and loyal staff.

CONSTRUCTIONAL WORK.

It was three years since the Association paid their last visit to the works. Now, as then, they found them busy with constructional work. Indeed, there always seemed to be constructional work to do. One of the most interesting things which the Association had seen was No. 6 retort house, which was an improvement on No. 7 house, which they had inspected on their former visit, and which was the first to be completely reconstructed. In a recent paper [see "JOURNAL" for June 28, 1922, p. 871] he had detailed the coke handling plant in No. 7 house. This had not been repeated in reconstructing No. 6 house, not because it was a failure, but because it was not all that could be desired. The new installation in No. 6 had proved highly satisfactory, and had reduced the wages bill. Whereas the cost, worked out on a 3-shift basis, for No. 7 house was 23d. per ton, this had been reduced to 17d. per ton in No. 6 house. They would have noticed that in the latter house they had installed a ferro-concrete incline, to obviate the effects of corrosion. With this innovation they were thoroughly satisfied. The life of mild steel troughs was about five years; and they were experimenting with ferro-concrete, with a view to prolonging this life. When they installed a rubber belt shuttle conveyor in No. 6 house, to distribute coke to the bunkers, they had been prepared for failure. It had, however, proved a great success, and had already handled no less than 150,000 tons of coke.

A RECORD OUTPUT.

The true value of the recent alterations at Beckton had been proved during the cold and foggy period in December last, when they produced on one day 95¾ million c.ft. of gas, as against their previous highest make of 84 millions. This enormous output, moreover, had been accomplished without any stretching of the gas, which had been sent out within the chemical limits set by the Company. In view of this record output, they could truly claim that Beckton was the largest gas station in the world; for the output of the Astoria Works, in the United States, had not yet reached 90 millions. In No. 6 retort house they obtained 120 therms per retort per day.

CARBONIZING TEMPERATURES.

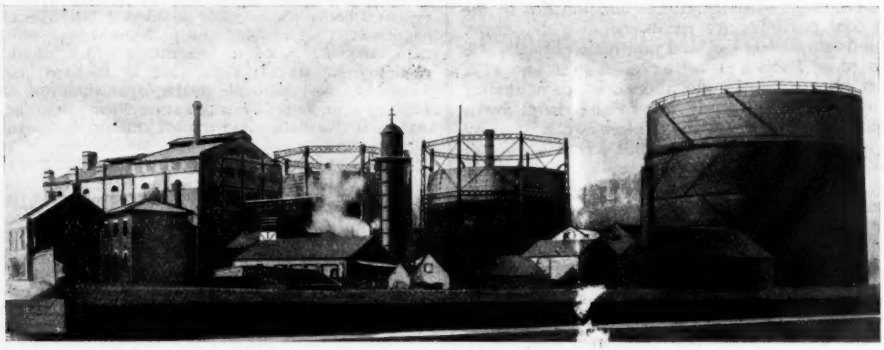
He would like to mention one or two points in connection with carbonizing temperatures. In certain quarters recently much attention had been paid to what he termed low temperatures—*i.e.*, from 1200° to 1250° C. The experience at Beckton was that the best working temperatures lay between 1350° and 1400° C. Only by these temperatures could they maintain a steady yield of over 71 therms per ton of coal. It had been suggested that, with the lower temperatures, the fuel used for heating the setting was less. At Beckton, with high temperatures, the figure for fuel consumption was 14 p.ct., which showed very fair working. It should be remembered that, though the waste gases left the setting at a higher temperature, the escape of heat was balanced by the quicker rate of carbonization. In any case, waste-heat boilers would nullify arguments in favour of the low temperatures. With high temperatures the question of refractories necessarily arose. At Beckton they had segmental silica retorts; and the manufacturers had discovered means of producing a material which had practically no after-expansion. He had recently seen a setting heated on the coke-oven system, where the flow of gases was reversed. This was excellent when one considered the life of the retorts.

MAGNETIC TREATMENT OF ASHES.

They had inspected an experimental plant for the magnetic separation of unburnt fuel from pan ash. This worked very satisfactorily, and offered many advantages over the flotation systems of separation. These, of course, worked well if the coke was dry; but often it was sodden, and had the same density as the clinker. He might mention that, with the magnetic plant, they had recovered as much as 50 p.ct. of coke from their pan ash. The process was clean, and the wear and tear on the plant small. Coke handling was a difficult problem. The object of many carbonizing engineers was to remove it from the retort house with all possible speed. Others wanted it treated lightly, in order to get a good type of coke for sale. Personally, he thought the dry quenching plant was the ideal system. It gave the coke a good colour, and when graded the coke looked very clean—a fact which was of great assistance in selling. There was no doubt that coke was the Cinderella of the gas industry. When it was realized that in the United Kingdom 20 million tons of coal were carbonized, producing 8 million tons of coke, the fallacy of the "take it or leave it" system of coke selling was apparent—particularly when they contrasted it with the efficiency and energy expended in the sale of gas. Much greater attention should be paid to this point; and it was up to the coke salesmen to do their utmost at the present time. Mr. Leech concluded by thanking the Association for their vote.

GAS-WORKS RECONSTRUCTION AT LEEK.

THERE was an inauguration yesterday of the reconstructed gas-works and the Glover-West vertical retort installation of the Leek Urban District Council; and the scheme of the Engineer and Manager (Mr. R. H. Ginman) which has thus been brought to fruition is described in a handsome souvenir booklet, from which the following description and illustrations have been taken.



THE RECONSTRUCTED WORKS.

In 1923 the Chairman and Committee decided, on the advice of Mr. Ginman, that the gas-making plant required to be replaced by modern apparatus. It was found to be obsolete in type and worn-out to such an extent as to be unsafe in itself, and incapable of extension. The only system which was capable of fulfilling the conditions—viz., to provide for new plant of sufficient capacity to be erected on the space which could be liberated during the summer months, so that gas manufacture could be kept in progress—was that of continuous carbonization in vertical retorts. As a matter of fact, it was shown that it would only be necessary to dismantle three-eighths of the existing inclined retort benches to provide space for the erection of vertical retorts capable of a daily production equal to that of the maximum requirements.

The preparation of the scheme and carrying it into effect was accomplished with characteristic celerity. In May, 1923, Mr. Ginman presented his report to the Committee, recommending the adoption of the Glover-West system of vertical retorts, of a daily capacity of three-quarters of a million c.ft., with coal and coke handling plant, a new exhauster and engine house, and a reconstruction and re-arrangement of the works at the north-east end of the retort house, including the provision of new water-cooled condensers, waste-heat boiler, a gas-fired boiler with boiler house and water tanks, a new mess room, and other improvements in the facilities provided for the comfort of the workpeople. In July, 1923, this scheme was approved by the Council. In September the inquiry of the Ministry of Health took place, and in October their sanction was received. In November the contract for the major portion of the work was let to West's Gas Improvement Company, Ltd., of Manchester, and in February, 1924, demolition of three-eighths the inclined retort plant was commenced.

The rearrangement of the mains, consequent on the provision of the new condensers and the removal of the exhausters to a fresh position, involved cessation of gas making; and for this the August holiday period was the only possible opportunity. All the new materials were therefore got ready and erected as far as possible, and on Aug. 5 gas making in the inclined retorts was shut-down at 6.0 a.m. The plan of operations had been very carefully thought-out beforehand, with the result that the connections were put in and gas was turned into the new mains at 6.30 p.m. on Aug. 7. Gas making in the Glover-West vertical retorts was commenced on Nov. 10. On Nov. 14 the inclined retorts were shut-down, and since then the town's supply has been furnished entirely by the vertical retort plant. Since this date, also, the daily demand has on certain days exceeded the previous records by as much as 25 p.ct., and it is certain that this demand could not possibly have been met by the whole of the inclined retort plant. In fact, the maximum daily demand has now exceeded the capacity even of the new installation.

COAL SUPPLY.

The coal is received by rail in wagons which are diverted from the main line to a siding to the west of Leek Railway Station. The works are separated from this siding by the main road. The wagons pass over a weigh-bridge, and thence to a mechanical wagon-tipper, by means of which the coal is discharged into a double-claw coal breaker. The broken coal is carried by a band conveyor in a tunnel under the road up an incline into the roof of the coal store. From the store coal it is elevated to the pushplate conveyor of the inclined retort bench, and is conveyed to the vertical retort conveyor by another band conveyor. Means are also provided for feeding coal from the elevator to the vertical retorts.

COAL AND COKE HANDLING IN THE RETORT HOUSE.

The vertical-retort bench is encircled by a conveyor of the recently introduced West lip-bucket type. This conveyor consists of buckets placed upon an endless chain which passes below the floor of the retort house (receiving coke as discharged direct from the retorts), up at the end of the retort bench, and out over the engine house, just beyond which the coke is delivered to a rotary screen. The chain then passes back to the retort house, up to and over the top of the coal-storage bunkers above the retort bench, and then down again to the floor of the house. Coal fed to the buckets on the bottom strand is conveyed and delivered to the coal storage bunkers.

Councillor J. Rhead, J.P.,
Chairman of the Council.

Mr. R. H. Ginman,
Engineer and Manager.

Councillor W. A. Furmston,
Chairman of Lighting Committee.

CARBONIZING PLANT.

The installation of Glover-West vertical retorts comprises twelve of the " New Model " retorts, elliptical in cross-section, 33 in. by 10 in. at the top, enlarging towards the base, where each retort is extended into a circular chamber. The bench is 25 ft. long.

The retort house building is merely an extension of the existing inclined retort house with a new steel and brick gable, presenting no particular difficulty in design or construction, while the effect is pleasingly in harmony with the rest of the works.

COKE STORAGE.

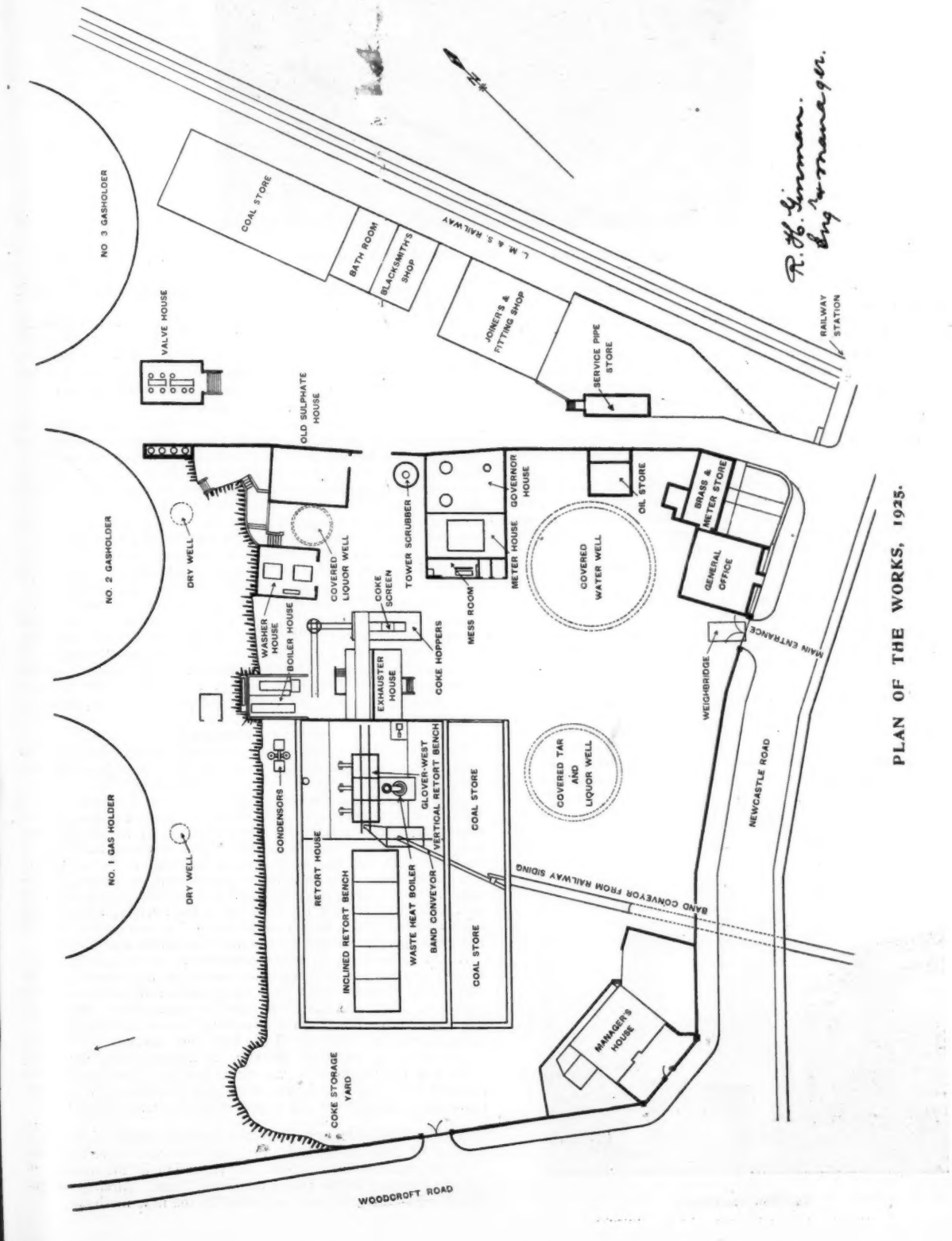
Coke is stored in a battery of hoppers constructed in a combination of steel cones lined with hard bricks and steel framework with hard brick filling.

Coke is delivered from the conveyor to a rotary screen, by means of which it is divided into breeze through $\frac{7}{8}$ in. diameter perforations, small through $1\frac{1}{4}$ in. diameter, nuts through $2\frac{1}{4}$ in. diameter, and large coke remaining. Five doors are provided in the bottom of the cones for the supply direct to vehicles; while there are four shoots, one for each of the sizes, with measuring chambers and clips for supplying coke to sacks.

STEAM-RAISING AND WASTE-HEAT RECOVERY.

Steam is raised for the manufacturing processes in three ways: (1) By the combustion of breeze in a Cornish boiler capable of evaporating 140 gallons of water per hour; (2) in a gas-fired boiler constructed on Kirke's patent, capable of evaporating 300 gallons per hour; and (3) in a West-Galloway water-tube boiler, heated by the waste gases from the retort settings, and capable of evaporating 100 gallons of water per hour.

The Cornish boiler is fired by breeze brought in side-tipping wagons from the coke hoppers. It is fitted with the " Turbine " patent furnace using steam jets for draught. In addition to the system of water-feed described later, this boiler is



PLAN OF THE WORKS, 1925.

THE VERTICALS AND THE EXHAUSTER HOUSE.

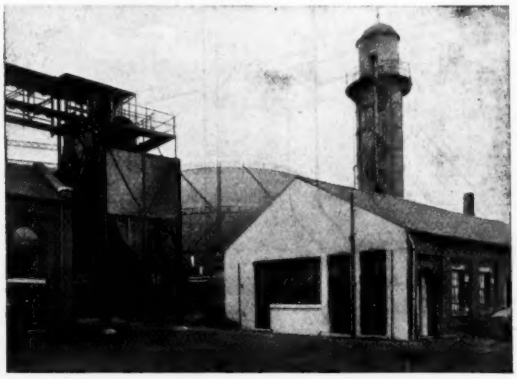
provided with an injector with an independent supply direct from the tank.

The gas-fired boiler is of the induced-draught fire-tube type, manufactured by Messrs. Spencer-Bonecourt. Gas is supplied to a burner in front of each of the 84 tubes from a 6-in. main. The flames and products of combustion are drawn through the tubes and ejected into the air either by way of a steel uptake or into the brick chimney flue by means of a fan, driven normally from the line shaft of the coke extractors of the vertical retort plant, or, as a stand-by, by an electric motor. This boiler also has a feed-water injector as a stand-by to the normal feed system.

The waste-heat boiler is operated on natural draught, and is placed in direct route of the products of combustion rising through and issuing from the vertical retort settings; by-pass dampers being arranged so that the waste gases can pass away by the chimney when the boiler is shut-down.

The cold water from the town main is delivered to a feed tank above the condensers. The water passes through the condensers, cooling the gas, and is heated to 150° Fahr., and passes to the boiler storage tank built as a portion of the boiler house roof. Eventually, however, it is intended to utilize an existing underground gasholder tank, 80 ft. in diameter and 20 ft. deep, into which all surface and rain water on the works is drawn. Water thus stored will be used for all condenser and boiler purposes—in fact, all works purposes except drinking.

The condensers form a syphon, from the top of which the heated water returns to the boiler storage tank; the water for the boilers being taken on the way by two boiler feed pumps, one of 400 and one of 200 gallons per hour capacity. The two pumps are controlled by a "Thermofeed" differential governor, which regulates the speed of the pumps to the demand; and the feed to each boiler is controlled by a "Thermofeed" automatic regulating device, while warning of low water is given by the whistles of the "Hilo" alarms fitted to each boiler.



The New Messroom.

These automatic appliances are of the manufacture of Messrs. Ronald Trist & Co.

It will be seen that this is a very complete system of economical steam raising. Both the waste-heat boiler of the retort settings and the breeze-fired boiler make use of waste products, while the gas-fired boiler is a stand-by which can be put into operation in a very few minutes as occasion may require.

CONDENSERS.

The two vertical water-tube condensers have also been specially designed by Messrs. R. & J. Dempster to give the maximum of flexibility of working and economy of operation. Each condenser is of half-a-million c.ft. daily capacity, and the two units are so connected that they can be operated in no less than nine different ways. They are provided with two 12-in. diameter central-passage fourway valves, together with 12 in. connections up to the main inlet and outlet of the valves.

The condensers are of the vertical rectangular design, divided into three compartments; the central or gas compartment being connected to the top and bottom water compartments by a series of tubes. Water enters the bottom compartment, passes upward through the tubes, and goes out at the top compartment. Gas enters the top compartment, in normal working, passes down round the tubes, and out at the opposite end to the centre compartment. The arrangement of the tubes is on the "Bearscot" principle, by means of which unrivalled facilities are provided for the inspecting, cleaning, and replacing of the tubes.

LABOUR CONDITIONS.

The conditions under which the new carbonizing plant is operated are a great improvement on what was possible with the inclined retort system.

Apart from the advantages inherent to the discharge of cool coke and to the provision of lip-bucket conveyors, the work of attending to the furnaces of the producers, of which there are two in the present installation, is reduced to about half-an-hour each per shift, and this work is much less than in the old type of bar grate, inasmuch as false-bar clinkering is entirely eliminated. In the step grates installed it is necessary only to break-up the fire and remove the ashes from the bottom, whence they are shovelled into a barrow and wheeled to the yard. This is the only operation entailing the use of a shovel and barrow.

At the same time, an important part of the extensions is the further provision which has been made for the comfort of the workmen. Already there were three baths and ample washing facilities. To these has been added a commodious messroom. The removal of the original exhauster house left the gable of the meter house exposed. This has been covered by building a new gable at sufficient distance to accommodate the messroom and the vestibule to the meter house. The messroom is finished with a tiled dado and floor, and is equipped with a gas stove for cooking food and a geyser for hot water supply.

It is confidently expected that the beneficial effect of the introduction of new methods in the reconstruction described will soon be apparent in a substantial reduction in the net cost of the gas supplied to the urban district of Leek. Already the gas furnished to the town has improved by the new methods.

TAR DISTILLATION BY THE "T.I.C." PROCESS.

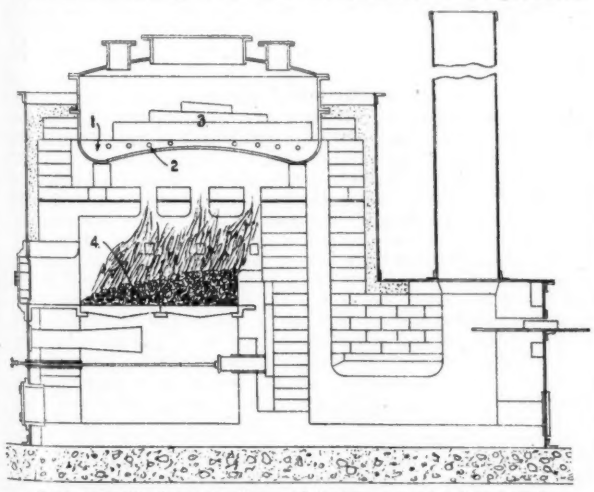
On Monday, Feb. 2, Mr. C. O. Condrup, B.Sc., A.I.C., A.M.I.Chem.E., of the Woodall-Duckham Companies, read a paper on "Tar Distillation by Means of the 'T.I.C.' (Lead Bath) Process," before the London Section of the Society of Chemical Industry.

Mr. Condrup first discussed certain broad aspects of tar distillation, and pointed out that much could be done from the point of view of economic and rational working if a practice were made of never sending wet tars to distillers, and if small producers were to try to meet local requirements for prepared tars and pitch. In most cases they could not hope to turn out the wide range of products which a distiller could manufacture, but they could certainly separate out their valuable light oils and light creosote when working to a road tar, and, in addition, when running to pitch, the heavy creosote and anthracene oils. The distillates so produced would be sent to distillers for separation into their ultimate constituents, and for the manufacture of standard tar products. Three alternative schemes for tar distillation were outlined.

1. The producer dehydrates the tar and obtains light oils and dehydrated tar, or light oils, light creosote, and road tar; the distiller buying the oils and dehydrated tar.
2. The producer runs his tar to pitch, and sells the tar distillates to a distiller.
3. The distiller buys the whole of the crude tar, and distils it. This scheme is, of course, not to be recommended.

Some of the differences between horizontal retort and vertical retort tars were touched on, and it was shown that there are features of vertical tar distillates which make these products peculiarly suitable for particular purposes.

After a rapid review of some of the typical tar stills, a description of the "T.I.C." plant was given, and it was indicated that this plant offers many possibilities to both small and large gas undertakings, and to the petroleum industry. The plant is very compact, and is run with little labour. The principle on which the "T.I.C." still operates is the rapid transference of heat through the still bottom to the tar by way of a cushion of lead which enables very large throughputs to be obtained from a small still with continuous operation, and with only a small quantity of tar in circuit. The layer of tar undergoing distillation is about ½ in. thick, and the tar passes through the still in three minutes. The use of lead removes all chance of the formation of carbon growths on the still-bottom, and the crude tar is dehydrated so rapidly that priming, even in the case of such intractable tars as water-gas tars, does not occur, with the result that fire risks are completely avoided. It was stated that very efficient fractionation is obtainable, and that the nature of the residue is under complete control, and can be varied at will to produce any desired type of residue. A diagram showing the setting of the still in the furnace was reproduced.



Diagrammatic Cross Section of Coke-Fired "T.I.C." Tar Still, with Meldrum Furnace.

1. Lead. 2. Heating coils. 3. Labyrinth. 4. Meldrum furnace.

The furnace in that instance was coke-fired, but gas heating and surface combustion furnaces have been installed in some of the plants which are in operation in various parts of the country, and at Joliet, U.S.A. A photograph of the Joliet plant as seen from an aeroplane was also shown. This plant has a throughput of 25 tons of tar per 24 hours.

A novel method of breaking-up pitch in the pitch bay was also described. A chain is arranged along the floor of the bay before the pitch is admitted, and is hauled up by means of a travelling winch, when the pitch has solidified, with the result that the whole of the pitch is broken up into lumps of convenient size, so that it may be removed with ease and without the vast amount of labour ordinarily involved. The Woodall-Duckham Companies, who are the owners of the "T.I.C." process, have also acquired the rights for this pitch breaker.

Attention was drawn to the further use of the "T.I.C." plant in connection with the preparation of "filled" tars and bitumen mixtures. To meet the conditions with which the roads of to-day have to contend, tar products of many different types are demanded, and their preparation is much facilitated when such additions as are called for to meet local requirements can be made on the spot, without the necessity of re-heating the tar.

Some interesting particulars were given, showing the results which have been obtained with "T.I.C." plants operating at Glastonbury and Aberystwyth, and it was demonstrated that very appreciable profits have accrued to these small gas undertakings consequent on their working-up their tar. In fact, it was made evident throughout the lecture that there is no justification for the prevalent idea that tar can only be profitably handled when it is treated in large bulk.

A scale model of the "T.I.C." plant was on view.

Discussion.

The CHAIRMAN (Dr. Bernard Dyer) said he had at times had to deal with the products of coal tar distillation in some form or other, but was not closely acquainted with the engineering aspect of the matter, and so was hardly in a position to comment upon the paper. He would call first upon Mr. Butterfield to contribute to the discussion.

Mr. W. J. A. BUTTERFIELD remarked that the question of the distillation of tar was largely an economic one; and whether it was advisable to distil in small units on the spot where the tar was produced, or to pass it on to distilleries dealing with large quantities from different sources, was a problem the best solution of which must vary from time to time. With regard to the differences between horizontal retort and coke-oven tars and vertical retort tars, the author had shown them some interesting diagrams, and had suggested that the plant described would work to give products to any distillation specification; but tar was very largely used now as a binding material for road construction or maintenance, and one might work with different tars, vertical or horizontal, to a given specification for distillation points, or consistency, or penetration, as the case might be, and the product would not be equally useful for its purpose. The tar from the majority of horizontal retort processes was a reasonably stable product, and its consistency did not change greatly in two or three weeks or two or three months, and therefore its value as a binding material remained substantially the same; but the tar from many of the newer processes, and the pitch resulting from that tar, were comparatively unstable commodities, and the binding characteristics changed and completely upset the intentions of the user. Speaking from the point of view of those who had to consider the product of the distillation process rather than the method of handling the material, he wondered whether something more than mere distillation was not required in a plant of this kind, in order that the product might be of a uniform character and stability. It seemed to him that the keenness of the competition of residual oil products and so-called bitumens as road-binders and for briquetting purposes was largely due to the fact that they were as a rule of a more uniform character than the tar products with which they competed. The tar distiller, in dealing with the modern tars, needed to treat them so as to secure a product which at the end of a few months of use would be in the same condition as it was originally. It was the want of uniformity in the product after ageing which required remedying.

Dr. W. R. ORMANDY thought there was an undoubted need of a simple plant for the distillation of small quantities of tar—particularly of those tars which contained finely emulsified water; but they would be touching on a dangerous problem in trying to persuade small undertakings to work-up their own material. In many cases it might be possible, but in many others it would be hardly desirable. That vertical retort tars should be more valuable than horizontal retort tars struck him as being unexpected. He would look forward with great interest to further particulars of the tars that had been distilled by this process put down in parallel with products from similar tar distilled by one of the older methods to which reference had been made.

Mr. F. POTTER, referring to the difference between vertical and horizontal retort tars, said it was sometimes argued that the former was, apparently of necessity, lower in phenols than the latter. His experience, based on analyses of tars from Glover-West and Woodall-Duckham plants, was that this was not necessarily so. With regard to the plant itself, he thought it should be regarded from two points of view. As a dehydrating plant, it had many advantages; but as a complete distillation plant he was not at all convinced that improvements could not be made in it. His impression of the plant was that the actual temperature of the tar in the lead bath still was not lower than in the ordinary pot still. This was of particular interest, because when one was dealing with horizontal retort tars which were somewhat high in free carbon, it was necessary that this free carbon should not be increased as a result of distillation. This might be accomplished by short time of distillation or low temperatures. Short time of distillation was obtained in this plant, but his impression was that low temperature was not. It would be interesting to know whether the plant worked side by side with a double pot still showed any fuel economy. He was inclined to think that it would.

Mr. W. H. COLEMAN asked if the lead employed in the plant remained fairly pure after use, and whether sulphiding was caused by the sulphur in the tar. It also seemed that the still-covers would be affected fairly quickly, as there seemed no provision to prevent condensation.

Dr. R. LESSING said he should suspect certain catalytic influences of the lead used in the process, and it would be interesting to know if sulphiding actually occurred. On the whole question of tar dis-

tillation, it was a matter for consideration whether the best practice was to distil the crude tar at high temperature. At the Fuel Research Station at Greenwich there was a plant dealing in that case with low-temperature tar, but it could be equally applied to high-temperature tar, the object being to separate the tar—before it was sent for distillation—by fractional solution and precipitating action (*i.e.*, by mixing the tar under suitable conditions of temperature with a solvent which dissolved the oil and precipitated the pitch). This could be done at as low a temperature as 100° C., and he suggested that such a treatment would be beneficial as a preliminary to ordinary tar distillation. If this were done, the process would be a very much simpler and smoother one, because the distillation of oil and the distillation of tar were two entirely different things, and the products of the two processes could be blended afterwards.

Mr. CONDRUP, replying, said that some of the information asked for was not available. The effect of ageing was hardly known yet, but road tars made from vertical retort tars were giving admirable service in various parts of the country. He had frequently looked for evidence of sulphiding of the lead of the plant, but so far it had not occurred. Even after several years there was no appreciable loss of lead. As regards the phenol content of vertical retort tars, he thought that he had made it clear that the phenol content of these tars was greater than that of horizontal tars. In connection with the dehydration of tar on a small scale, it was a fact that some small gas undertakings with an annual output of tar sufficient to keep their T.I.C. plant at work for only three weeks in the year had been able to show handsome returns, which had enabled them to write-off a great part of the cost of the plant after working for a few weeks only.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

Last Saturday afternoon the Western Juniors met in the Royal Technical College, Glasgow, when there was a very gratifying attendance.

Mr. J. M'ISAAC (the President) took the chair, and explained that this was the first of the Council's experiments—viz., having two short communications read on the same afternoon by members who were writing papers for the first time. The Council hoped in this way to bring-out fresh talent from the membership, and he asked for the sympathetic and enthusiastic support of everyone.

LABORATORY ROUTINE AND THE DUTIES OF A CHEMIST IN A MEDIUM-SIZED GAS-WORKS.

By JAMES W. BOYLE, of Greenock.

In gas-works chemistry the routine of the laboratory must essentially be governed by local circumstances; but tests should as far as possible be carried out continuously and regularly. My object in presenting this paper is to give a résumé of such routine as it might be undertaken in a medium-sized works, and as it is carried out at Greenock. The whole purpose of laboratory routine may be summarized in one word, "Economy"; and though economy and efficiency should go hand in hand, it should also be remembered that efficiency may be carried to a stage where it ceases to be profitable.

In every test he carries out, even though it is but a routine test, the chemist should think in terms of money to be saved, or otherwise the amount of money he is going to make for his undertaking by preventing waste or improving a process; and to enable him to do this efficiently, he should have a commercial instinct and acquire an early knowledge of costs. I am convinced that the work of many a chemist is valueless because he cannot, or does not, translate the result of his investigations into terms of £ *s. d.* To cite an example, a test on waste ammoniacal liquor shows a percentage of fixed ammonia to be passing off with the liquor. Before taking action to recover this, the chemist should decide whether the value of the ammonia would be greater than the expenditure on the extra lime required to recover it.

Every test has its own special bearing on economical working of plant or in the use of raw material; and with a view to illustrating this fact, I propose to deal with the subject under various heads.

CALORIFIC POWER OF GAS.

Many of you will have read recently that considerable amounts of money may not be realized by gas undertakings owing to the "Safety First" idea when supplying gas on the therm basis—that is to say, the difference between the declared standard and the standard in actual practice. It has been calculated that if a large company supplying about 15,000 million c.ft. of gas per annum allow what appears to them to be a reasonable margin of 6·4 B.Th.U. above the declared calorific value, they might lose in a year from those free units nearly a million therms, representing, at 9d. per therm, a loss in revenue of over £37,000. Calculated on this basis, an undertaking supplying 562 million c.ft. would lose 35,968 therms, representing a loss of revenue of approximately £1350 per annum.

We do our very utmost to prevent loss of revenue from this source, by keeping the calorific value as near to the declared standard as possible; and with systematized supervision, this is not too difficult a task. When the calorific value rises above the declared value, it practically means—in steamed vertical retorts at all events—that either more coal is being carbonized or less steam is being used, at that particular time, than is necessary to keep the calorific value at its proper level. Of course, there are other factors, but these are perhaps the chief ones. When the calorific value falls materially below the declared quality, there is probably too slow a coal feed and too much steam in the retorts. To ensure a reasonably steady quality at the holder inlet, indicating and recording calorimeters are consulted by the shift foreman.

Assuming that the retorting of the coal is properly attended to, our method of regulating the calorific value is by regular and constant tests on the holder outlet and inlet. Four tests are made daily on the standardized Boys' calorimeter, two in the morning and two in the afternoon; the average of these four tests being taken as the calorific value for the day. Two of these tests are checked by tests on the Simmance recording calorimeter, and after each test the handy and reliable Peebles and Simmance indicating calorimeters are checked and adjusted if necessary. The carbonizing staff are then acquainted with the result of the laboratory tests, so that they may make any necessary adjustments of plant. No adjustments, however, are made for trifling variations in quality.

In the forenoon a further test is made on the holder inlet by a Simmance Canadian pattern calorimeter in the meter house, and the "Sigma" indicating and Beasley recording calorimeters in the same building are checked by this test and, if necessary, adjusted. The Beasley calorimeter has been fitted with the new attachment, which varies the volume of gas passed in accordance with changes of temperature, pressure, and humidity, and records every fluctuation of calorific value with a degree of accuracy highly suitable for reading the quality of gas being made from hour to hour. The calorimeter is set each evening in a bath of water treated with sodium carbonate. Each day the meter is correctly water-lined, and every Monday water under pressure is forced through the calorimeter to ensure cleanliness and accuracy. On Saturdays and Sundays, during the forenoon, one test is made in the meter house and two are made in the laboratory.

COAL.

Every other day tests on coal are carried out by the platinum crucible method. These tests serve to show whether the quality of coal supplied is being kept "up to the scratch;" and incidentally I may mention that the employee who tips the coal wagons has to report on any wagon of coal which does not come up to the standard of cleanliness. He is on the look-out for stones, dirt, and sundry rubbish, and I am sorry to say he is often pretty busy noting faults. All coke, breeze, coke from pan ash, &c., is tested by the same method.

To obtain accurate statistics, the coal storage hoppers above the retorts are levelled every Thursday at 5 p.m., and the make of gas per ton calculated. An accurate test on the makes of gas, tar, ammonia, and coke, and cost sheets for the same are made out every month.

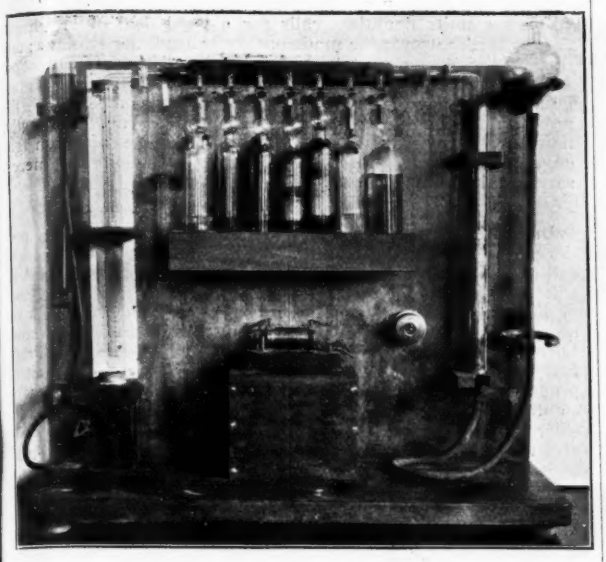
AMMONIACAL LIQUOR.

Much can be done to prevent waste under this head. In our works pure liquor ammonia is manufactured in lieu of sulphate of ammonia, and the waste gases emanating from the still can be directed at will to the foul main or *via* the main flue to the chimney. Tests are carried out on these gases, and should they be found to contain any ammonia they are temporarily directed to the foul main to join the coal gas stream on its way to the wet purification plant, where the ammonia is recovered.

Samples of waste liquor from the stills are collected daily and tested by distillation with caustic potash, and if found to contain an excess of fixed ammonia, more milk of lime is admitted. Should there be the minutest trace of volatile ammonia—a rare occurrence—more steam may be required. Conversely, should no ammonia, or only a slight trace of it, be present, it is assumed that excess of lime or steam is being used; and this can be suitably reduced. By such tests waste is eliminated and a saving is accomplished; and if the shift operators pay strict attention to instructions, the saving is enhanced by reason of their carefulness. The weight of lime, gallons of wash oil, caustic soda, &c., used are regularly recorded by the operators on their daily report sheet.

GAS ANALYSIS.

A complete gas analysis is carried out daily in combination with a test to ascertain the specific gravity of the gas. The gas analysis apparatus used by us has been built to our own design to facilitate accuracy and quickness in making the test. The measuring burette and explosion pipette are of the same length, and are supported vertically on opposite ends of a board. Their upper ends are connected directly to each other by a seven-branch capillary tube, which carries six absorption pipettes and a Davidson wash-bottle, all of which rest on a box shelf. The wash-bottle is filled with acidified water, for clearing the capillary tube along to the measuring burette; and the mercury from the explosion pipette is drawn along to the wash-bottle, to clear the remaining part of the capillary tube. The pipettes



Greenock Gas Analysis Apparatus.

being all connected to one capillary tube enables the operator to pass the gas sample into any one of them by simply opening the stopcock.

The accumulator and sparking coil are covered-in, and from them the wires are led through to the back of the board, where they are connected to the switch, and then back again through the board to the explosion pipette. When the sample is ready in the pipette, the explosion is accomplished by depressing the arm of the switch. A complete analysis, including calculations and recording, can be carried out with this apparatus in 46 minutes. It might also be claimed for this apparatus that, with ordinary care, breakages are reduced to practically *nil*.

The figures used by us in calculating the calorific value of the gas are :

C_nH_m (illuminants), 2319 ; CO (carbon monoxide), 330
CH_4 (methane), 1024 ; H_2 (hydrogen), 325

The calorific value resulting from the use of these figures approximates very closely to that found on the Boys' calorimeter, provided the analysis sample is aspirated at the same time as the calorific value test is carried out, and the room is kept at constant temperature throughout the analysis. This latter condition is most important, as even a slight change of temperature affects the result. On Sunday the analysis is carried out up to the extraction of carbon monoxide only. As a check, an occasional analysis is carried out on the "Birmingham" apparatus, when the nitrogen content is found to be very slightly higher than in the daily analysis.

The daily analysis of town gas is valuable in three ways. It assists greatly in supplying consumers with a gas of constant composition, in conjunction with constant calorific value and specific gravity; it is a valuable aid to the economical working of the plant; and it ensures the elimination, as far as possible, of carbon dioxide and free oxygen, which, in the presence of moisture, do so much harm to mains and services, and more particularly to the delicate structure of consumers' meters.

Pure Liquor Ammonia.

Immediately before a tank wagon of liquor ammonia is dispatched, three samples are drawn from the tank by a long sampling tube. Two of the samples are sealed—one as the laboratory sample and the other for the purchaser. The third is used for the tests; and as it is from the results of these tests that the value of this bye-product is computed, it is necessary that the testing should be carried out with the utmost care and exactitude. There are various methods of testing; and of the two which are reliable, I give the following as an example.

A small bottle fitted with a glass stopper is weighed, and then about 3 grams of ammonia run into it down a glass rod, and again weighed. The difference between the two weights gives the amount of ammonia taken. The bottle with the stopper in position is quickly introduced into a conical flask containing 50 c.c. normal sulphuric acid and about 200 c.c. of distilled water. The conical flask is then very gently heated over a bunsen flame protected by wire gauze; its contents being kept circulating until the heat forces the stopper out of the bottle. In this way thorough mixing is assured, and the ammonia is immediately and completely neutralized by the acid. After the solution has been cooled, the excess acid is found by titration with semi-normal sodium hydrate.

The calculation then is :

$$\frac{\text{N/1 Acid} = \text{N/1 Soda} \times \cdot017 \times 100}{\text{Weight of ammonia taken}} = \text{percentage ammonia by volume.}$$

It is important that no ammonia vapour should be in the room during tests, and that the neck of the conical flask should be "washed-in" just before the end or neutral point is reached.

Pure liquor ammonia is also tested by a colour standard for the presence of pyridine.

Test for Sulphur and Ammonia in Purified Gas.

The Gas Referees' tests for sulphur and ammonia in purified gas are carried out twice a week. The information gained from these tests shows whether ammonia (which is a recognized corrosive agent, as well as a valuable bye-product) is present in the town gas, and whether the dry purifiers are efficiently arresting the sulphur compounds. The three minutes' test with lead-acetate paper prescribed for the detection of sulphuretted hydrogen in gas is specially made each morning, but in addition this test is continually in operation.

Occasionally tests for sulphur compounds are also made on the inlet and outlet of the purifiers, to check their efficiency.

Control of Scrubbers, Washers, and Condensers.

Gas entering the washers, &c., is tested for sulphuretted hydrogen and ammonia. The outlets are also tested to see if the machines are working efficiently.

With a view to reducing the carbon dioxide and sulphuretted hydrogen content of the gas to a minimum, experiments have been tried in a naphthalene washer at the purifier outlet, but so far without commercial success.

Tar.

The only test we carry out on tar is for specific gravity, which is generally about 1·09. From this figure and the steelyard weight we calculate the number of gallons in the tank wagons dispatched to the distiller.

Occasional Tests.

Tests for the sulphur content of spent oxide of iron and for naphthalene in purified gas may be classed as occasional tests—very little of the latter being found in the gas from vertical retorts. An occasional test is, however, made to ascertain that this very desirable state of affairs continues.

Records.

A record of each of the tests mentioned, with the exception of coal tests, is kept in the daily record book of the laboratory, and this book lies open on the laboratory table. The tests on coals are kept in a separate book, and about the end of the financial year they are grouped on suitable sheets in order of value according to ash content and volatile organic matter (wet and dry basis). The information thus obtained is a valuable aid to selection of coals for the ensuing year.

A number of recorder charts are changed at noon daily, the previous day's charts being laid on the laboratory table for inspection and comment by reasonable officials. Charts from each district of the town are also brought in, showing the pressure in the low and high pressure mains for the previous 24 hours. A weekly chart showing the temperature of the gas in a trunk main on the district is similarly handed in.

Official Tests.

The Gas Examiner tests the gas for calorific value once a week, and from his notifications we construct a graph showing the weekly calorific value as found by him, and also a graph showing the average of our own daily tests throughout the quarter. From these graphs we can see at a glance how we are placed in regard to deviation from standard requirements.

It may not be out of place, in conclusion, to refer to economy in the laboratory itself. The chemical control of processes requires expensive apparatus and materials, which, of course, are an addition to the cost of production. Results therefore are expected to justify the cost of control, and the lower the expense of running the laboratory, compatible with efficiency, the easier this justification becomes. Laboratories are very necessary, but even they must be run on commercial lines. It may be, for instance, that new furnishings are ordered to carry out some test which could be done quite as efficiently, and at less cost, with apparatus constructed from material already available. This is a matter which requires careful thought, and the painstaking chemist will not neglect it. Generally speaking, the chemist should first of all practise economy and perfection in his own department, and then insist upon it in the other departments under his supervision. We have known it to be otherwise.

I should like to express my indebtedness to Mr. Keillor for his kindness in granting me permission to present to you the facts and figures contained in this paper.

Discussion.

Mr. Robert Gray (Hamilton) said there was now no doubt in the industry as to the importance of the chemist. In recent years this had been more and more realized. He thought they might be a possibility of a number of small works having a full-time chemist between them. The observations of the chemist must be converted into terms of money, if they were to be of practical use, and in all works a proper system of chemical control established. From what they had just heard, such control was in evidence in Greenock; and in that district they benefited accordingly.

Mr. Robert Sturrock (Ardrossan) remarked that in gas analysis he had always found it advisable to use two pipettes.

We are holding over until next week the second paper, which was by Mr. S. M'Gowan, of Dalmarnock, on "Coal Testing."

CHEAP POWER PRODUCTION.

COMBINED GAS AND ELECTRICITY UNDERTAKINGS.

By J. G. WALTHEW, M.I.Mech.E.

[Extracts from a paper read before the Chelmsford Engineering Society on Thursday, Feb. 5.]

The idea of cheap power production as the outcome of a combination of interests of gas and electricity undertakings is not new, and it is somewhat remarkable that more development has not already taken place on these lines. Excepting a few isolated cases in various parts of this country and Ireland, it was not until Mr. A. Hugh Seabrook gave special attention to the subject that any real progress was made. Since then it is possible to point to a number of combined gas and electricity stations which have proved both successful and economical in operation. Mr. Seabrook has previously read a paper before this Society, which dealt very thoroughly with the economic advantages of the scheme; and it is now proposed to add a few notes relating more particularly to a comparison of advantages and economy obtained from different types of internal combustion engines.

The jealous feeling that has for so long existed between gas undertakings and electricity undertakings is probably one reason why more effort has not been made in the past towards a fusion of these interests. Fortunately, there now exists a better spirit and a desire to co-operate in the public interest. The public realize that gas-works should be utilized to make better use of the coal resources of this country, and not chiefly to manufacture gas at a price for commercial and domestic use. Already the residuals obtained by the scientific treatment of coal at the gas-works yield a considerable revenue which makes it possible to lower the price at which town gas is sold to consumers. It is possible that more can be done in this direction. Then, as you are aware, town gas formerly sold at a certain price per thousand cubic feet is now sold in many districts on the therm standard of measurement; and this is greatly to the interest of the consumer.

The present aim in gas undertakings is to get the maximum "gas make" from each ton of coal, rather than to increase the yield of residuals. The future trend may be to give rather more consideration to the residuals, coke, benzole, tar, oils, &c., and to consider the gas more as a bye-product. There are also certain possibilities in the manufacture of low-temperature fuel for household purposes. Though existing plant may not be suitable for making this fuel, the gas-works is the source from which supplies should eventually be obtained. Any development that will help to reduce the selling price of town gas will increase the demand for power and heating purposes, and will in turn further improve manufacturing conditions at the gas-works.

ELECTRICITY GENERATION FROM TOWN GAS.

As to whether it is really an economical proposition to generate electricity on a large scale by using town gas engines as power units doubtless calls for a good deal of argument. A case can, however, be made out for the smaller stations; and in any event it is a mistake to think only in terms of fuel cost per unit generated, for, judging solely from this standpoint, it must be admitted that the town gas engine cannot compete with the producer gas engine or with the crude oil engine. Indirectly, however, many savings accrue from the use of town gas engines; and under present-day working conditions it is necessary to take a broad view.

PRODUCER GAS ENGINES.

In considering the question of power generation from producer gas, it must be admitted that there has been a marked falling off in demand during recent years for power plant of this description. This is mainly because of the additional cost of labour. There is also the cost of water and materials required for the scrubbing and cleaning apparatus. Fuel costs have increased, and freight charges on bituminous or low-grade fuel have had the effect of adding further to its cost, out of proportion to the heating value of this class of fuel. The capital cost of gas plant suitable for bituminous fuels is considerably more than for anthracite. The attendance costs are also more; and for these reasons anthracite has been selected in making the cost comparisons later with reference to the producer gas engine.

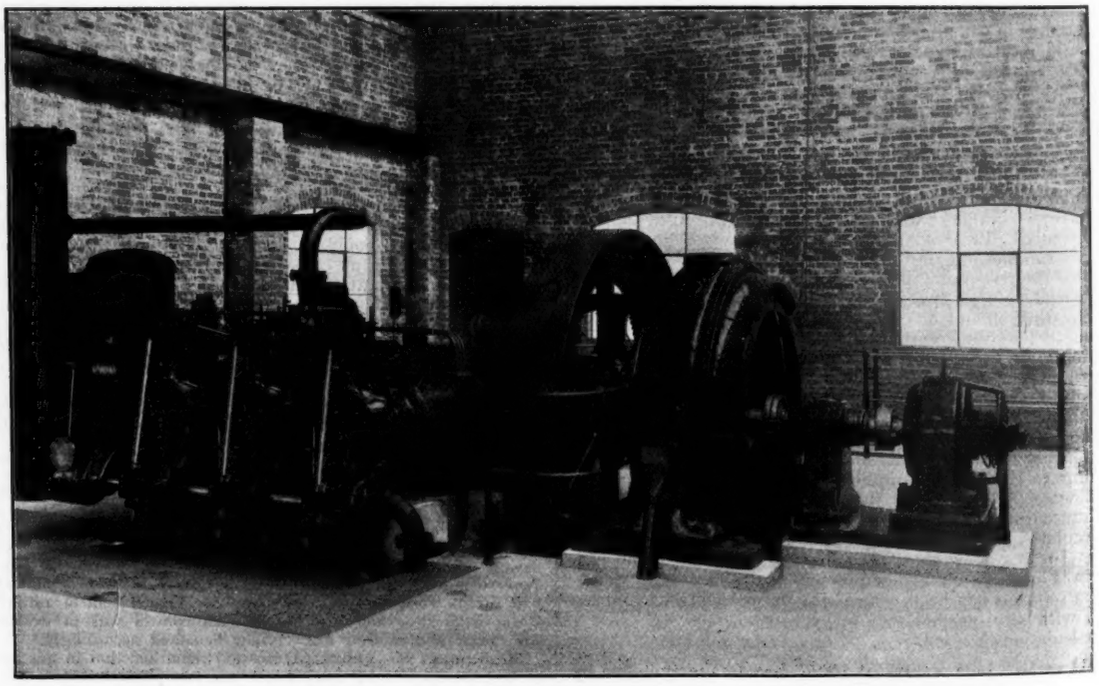
OIL ENGINES.

The cold-starting heavy oil engine has proved a formidable competitor to the producer gas engine, and to-day the oil engine probably represents the cheapest form of power to be obtained in this country, when fuel has to be purchased. The exception may be where waste fuels are available. The oil engine has the advantage of being a complete unit in itself, so that the capital cost is less than for the gas engine and producer gas plant. There is the further advantage that the oil engine requires less floor space, with consequent saving in cost of foundations and buildings compared with the gas engine and producer gas plant. There are no stand-by losses, and the fact that so little attention is required in the running makes oil engines an attractive proposition.

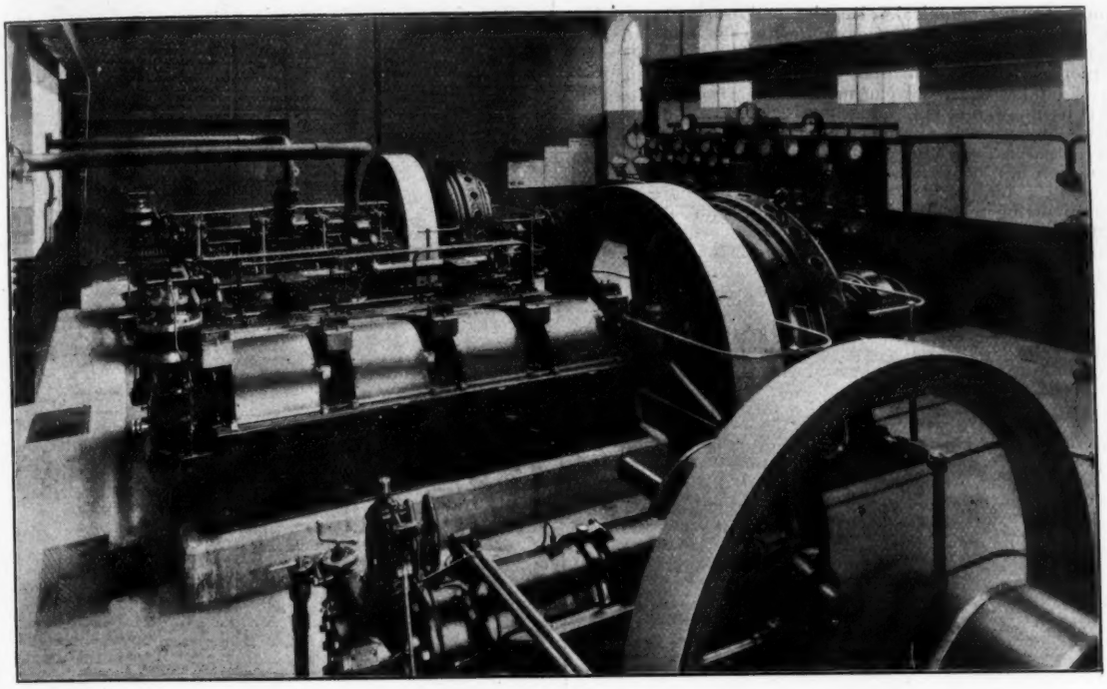
TOWN GAS ENGINES.

A town gas engine installation involves the least capital expenditure. The floor space and foundations and buildings cost less, if anything, than for oil engine plant, because no fuel storage is required. The town gas engine has equal advantage with the oil engine in having no stand-by losses, and in starting up immediately from cold, thus making it especially suitable for electricity stations. Town gas is available day and night by merely turning on the gas cock. In regard to cleanliness in working, and freedom from wear and tear, the town gas engine probably fulfils these conditions better than any other type of internal combustion engine. It will be seen, therefore, that there is much to recommend the use of town gas engines from the standpoint of the engineer in charge of the electricity station.

Notwithstanding these many advantages, the main point is the price at which town gas is debited against the electricity



CROWBOROUGH DISTRICT GAS AND ELECTRICITY COMPANY—100-KW. "PREMIER-CROMPTON" DIRECT COUPLED SET.



SWANAGE GAS AND ELECTRICITY COMPANY—100-KW. "PREMIER-CROMPTON" SETS.

undertaking; but it is reasonable to say that this should not exceed the cost at which the gas is put into the holder, after allowing full credit for the residuals. There are no distribution costs, and no selling costs. It should be possible under these conditions to charge from 3½d. to 4d. per therm. At the higher figure the fuel cost to generate electricity by means of town gas engines working at full load is in the region of 0·59d. per unit. There are other costs to be added before arriving at the final cost of generation, and these are given in detail in the table which follows.

Comparison of Costs.

In order to show a comparison between the cost of generating electricity from (1) town gas, (2) producer gas, and (3) fuel oil, the following fuel prices have been assumed.

1. **Town gas** . . . . . 4d. per therm
2. **Producer gas** . . . . . 45s. per ton, anthracite
3. **Fuel oil** . . . . . 95s. per ton

The following table gives the working costs of a 1000-KW. generating station with power plant comprising four units, each of 250-KW. capacity (one set being stand-by), and shows the approximate capital cost, according to the type of prime movers installed, with details of the cost per unit generated. An average load factor of 25 p.ct. is assumed. Attendance charges comprise day and night working. The capital costs include the power units with direct-coupled alternators, 460 volts, 3 phase, complete with starting equipment, water cooling plant, and all pipe work, delivered and fixed on site, but excludes cost of switchgear, foundations, and buildings. Though the costs are not complete, they will afford a means of comparison between the three different types of prime movers.

Generating Station of 1000 KW. Total Capacity.
(4 units, each 250 KW.)

Type of Prime Movers.	Capital Cost 4 Units.		Cost per Unit Generated—25 P.Ct. Load Factor.						
	Total Plant.	Per KW.	Fuel.	Lub. Oil.	Attd.	Int. at 6 P.Ct.	Dept. at 5 P.Ct.	Rep's, &c., at 3 P.Ct.	Total Cost per Unit.
	£	£	Pence.						
Town gas engines .	18,000	18	·755	043	·074	·118	·099	·059	1·149
Producer gas engines .	21,500	21·5	·410	043	·137	·142	·118	·071	·921
Oil engines .	20,000	20	·390	·047	·074	·132	·110	·066	·819

Fuel Costs.
As above.
Lubricating oil, 3s. per gallon

Attendance Costs—Day and Night.

			Per Week.
Town gas engines . .	1 engineer(s)	1 assistant . . (2 shifts)	£13
Producer gas. . . .	2 ,,	2 ,, . . ,,	£24
Oil engine	1 ,,	1 ,, . . ,,	£13

Average KW.-hours per week, 42,000 units.

It is assumed that alternating current supply would be required, and that the sets would have to operate in parallel. This necessitates the use of three or four cylinder 4-stroke cycle engines if direct-coupled sets are installed. The capital cost figures referred to provide for prime movers of this type. The question of running in parallel offers no serious difficulty to-day, but incidentally it is an easier problem with town gas engines or with oil engines than with producer gas engines. With the latter, special arrangements must be provided to ensure thorough mixing of the producer gas supplied to each engine to ensure the quality being as consistent as possible. The advantages of town gas in this respect will be apparent, being more consistent in quality, and therefore more suitable for driving engines required to run in parallel.

The chief point to be noted in making these comparisons is the small difference between the "final costs" to generate electricity by each system after taking capital and attendance and other charges into account. Though the cost to generate from town gas is rather more than for producer gas or oil, the question is whether other advantages do not outweigh in favour of the town gas engine when considered in conjunction with a gas undertaking. An advantage not previously referred to is "less handling" with the town gas sets, as no fuel oil storage is needed, and similarly no auxiliary apparatus such as gas plants and cleaning apparatus.

Horizontal v. Vertical Engines.

The question as to whether the horizontal or the vertical type engine is most suitable is bound to reveal differences of opinion. The author would submit that the advantages are greatly in favour of the horizontal type multi-cylinder engine for reliability and economy. As regards turning moment, the horizontal engine with the same number of working cylinders and cranks as the vertical engine is equal to it for steady turning and is, therefore, just as suitable for driving direct-coupled alternators. The floor space occupied is in practice very little more than for the vertical engine. It is obvious that the over-all length measured along the crankshaft will be the same. Considered from the front of the crank-chamber to the back of the cylinders, the horizontal arrangement is more; but when the overhead platform and ladder for the vertical set are considered, it will be found that the extra floor space required does not exceed 20 p.ct. To offset this there is a saving in cost of buildings, which must be higher for the vertical engine station, and be provided with special lifting facilities.

The first cost of the A.C. machines is rather more to suit the slower speed engine, but the horizontal engine implies greater safety in operation and reduced wear and tear, because of fewer reversals of the reciprocating parts. Lubricating oil costs are less for horizontal than for vertical engines. The prime advantage, however, with the horizontal engine is the immeasurably better facility for inspection. Crankshaft bearings can be readily examined. All engine details including pistons and valves are easily accessible from the floor. The inspection or removal of pistons with the vertical engine involves much labour, so that often this work is neglected. In regard to fuel consumption, horizontal engines are, generally

speaking, more economical. Repairs and renewals are less costly, and carried out in far less time. The lubrication of cylinders and pistons for the horizontal engine is obviously a much more simple problem than for the vertical; and in practice it is found that the wear upon the horizontally moving piston is no more, and is frequently less, than with the vertical piston, as any wear is due to ring friction rather than to the weight of the piston on the cylinder liner.

The design and construction of the cylinder breech end and the valve gear for the vertical type engine is a more difficult problem than for the horizontal. It is difficult to arrange adequate water jacket space with vertical cylinder heads; and dangers of cracked heads and pistons arise. Insufficient cooling arrangements frequently lead to this kind of trouble, and are made worse where the cooling water contains scaly or other deposit.

The horizontal engine cylinder and breech end can be arranged with ample water spaces, and be provided with cleaning and inspection doors to give facilities impossible in the case of vertical engines.

CONVERTIBLE ENGINES.

If desired, or for emergency use, one or more of the town gas engine sets in the station could be made convertible to use as an oil engine. The additional cost entailed is not large, provided this is arranged for when the engines are first installed. The power developed remains the same when using town gas or oil as fuel.

Discussion.

The PRESIDENT (Mr. T. W. Cooper), in inviting discussion, said he was particularly pleased to think that the author, in the illustrations accompanying the paper, had been able to include so many sets of engines which had originated in Chelmsford.

Mr. A. HUGH SEABROOK (Consulting Engineer) referred to the recent progress in the direction of combining gas and electricity stations. A number of combined stations were running, and about eight or nine corporations owning gas-undertakings were applying to Parliament for powers, and in some cases had obtained powers, to supply electricity; the electricity undertakings to be run in conjunction with the existing gas undertakings. An engineer acting in an advisory capacity had to keep an eye on the balance-sheet, as well as on the technical aspect of this problem; and one of the principal objects was to ensure a reasonable profit being earned on the capital invested in the electricity side of the business. The only way at present—in rural districts, at any rate—of ensuring this was to utilize the existing gas-works organization and staff, which, during the first year or two, required a very small addition to enable it to take care of the electricity section. After about four or five years, the scheme would be on its feet, and could stand the expense of a special organization, if required. People to-day would not invest capital in public utility projects unless the advisory engineer could show a reasonable prospect of dividends being paid, at the outside, within the second financial year. The time had gone when either shareholders or ratepayers would stand the incubus of unremunerative public utility undertakings which had to be subsidized for ten, and in some cases fifteen, years. This tendency was healthy; and he did not believe in a business which could not stand on its feet financially. The scope for combined undertakings was enormous. East Anglia was a typical district for such installations. It was rural, there were not many factories and industries, and it had to be treated electrically in a totally different manner from the industrial areas. Nobody would dream of putting down combined gas and electricity undertakings in the coal or iron and steel districts. At present, the solution in the latter case was the large steam-driven generating station. Unfortunately, however, many engineers were apt to dogmatize, and to suggest that a treatment of the problem suitable for one district should be suitable for the rest of the country. One of the most glaring instances of dogmatizing in engineering science was the way in which the big super-station was being boomed. It constituted a solution for certain districts, but was not applicable to districts where the number of consumers would be small. Attempts were being made—unfairly, he thought—to subsidize the installation of heavy transmission mains from super-power stations. These mains could not earn a sufficient income to enable them to be commercially successful. The author had referred to the fuel costs, with engines using town gas, being higher than with other engines. This was right on fuel alone. He knew of several cases where electric supply companies, for instance, had thought they would connect up with gas undertakings, and buy gas, in order to reduce costs. A combined gas and electricity undertaking could only be run satisfactorily provided it was owned by the same people. Where an electricity and a gas undertaking were under the same ownership, and where the gas output was (say) over 40 million c.ft. per annum, the author's figure of 4d. per therm was the price at which they were prepared to supply gas to the electricity plant, and this represented practically the cost of gas into the holder. As to the incidental advantages which counteracted the higher cost of town gas, as compared with the cost of oil, he said that for a great part of the 24 hours—which amounted to a good many hours in the whole year—there was a very small demand for electricity, and during that time a small gas-engine driven set could be run. In some parts of the year this might be for 16 or 18 hours out of the 24. The gas-engine driven plant could be run without attendance. It was usually a 25, 30, or 40 KW. set; and the man who was looking after the gas-engine driven exhausters and blowers, &c., for the gas-works could look after the gas-engine driven electricity plant as well. He would not like to leave an oil engine, even for a 40-KW. set, with no attendance during the night. Another factor which could only be effected by combined ownership was that the increased use of gas for the engines driving the electricity plant decreased the proportion of overhead charges in gas-making. He wished that the developments in gas-oil engines referred to in the paper had been effected two or three years ago. He remembered cases in which capital had had to be spent on increasing the gas-making plant, with the result that gas was more costly, and he would have turned over to oil instead of town gas for a period for generating electricity. Even in a gas-works where they were not proposing to increase the gas-making capacity, there was a distinct advantage in using town gas at certain times of the year, when gas was plentiful and cheap, and turning over to oil at times when the demand for gas was greater. That did bring about a decrease in the fuel costs of these plants. Both the oil and the gas fuel could be supplied by the gas-works, because it required a very slight treatment of tar oil to make it suitable for heavy oil engines. As to the astonishing developments in internal combustion engines, he pointed to the extraordinary results at present obtained with the two-stroke oil engine, which, not many years ago, was regarded as inefficient compared with the four-stroke engine. As to gas engines, in Germany they were still using the slow-speed horizontal engine, where they could get blast-furnace and coke-oven gas. They were getting extraordinary thermal efficiencies by using the exhaust heat from the gas engine—36 p.ct. and over, as against 20 p.ct. with the ordinary steam engine. These developments indicated a transition from the steam stage to that of the internal combustion engine, whether of the reciprocating or turbine type. As to horizontal *versus* vertical engines, he was convinced that the vertical engine was inferior in every respect to the horizontal. If he could not have a horizontal engine, he would have a turbine. As to the costs of the various plants mentioned in the paper, the author had given a figure of 3 p.ct. for repairs and maintenance all the way through, whereas the figure with town gas engines was lower than with oil and producer gas plants.

Capt. H. RIALL SANKEY (late President of the Institution of Mechanical Engineers), referring to Mr. Seabrook's remarks as to the cost and difficulty of putting down electric mains in rural areas, asked whether, in the case of a gas-works supplying gas for producing electricity, existing gas mains could be used to take the gas to some outlying village, where a gas engine could be installed for producing electricity. This would save the expense of laying electricity conductors, and was an aspect of the problem worthy of some consideration. The author had stated that, by means of town gas engines working at full load, the cost of generating electricity would be in the region of 0·59d. per unit. This, obviously, was for a very small plant—250 KW. as a maximum. It was useful to consider an important item in connection with all internal combustion engines—*i.e.*, that the economy of fuel in small units, except when they were very small indeed, was as good as that in big units. With the steam engine, however, there was a totally different state of things. The small engine was uneconomical, and they had to go to the large sizes in order to get economy. Therefore, if there were to be small stations dotted about—as he believed would probably be the right thing to do in certain cases—internal combustion engines must be adopted if economy were to be obtained. In confirmation of his point that small internal combustion engines were as economical in fuel as the big ones, he instanced a case in which he had had to estimate the costs of a plant for a total output of the order of 20,000 KW. The engines were to be ordinary producer gas engines, and the total cost of generating electricity came out to 0·5d. per unit. As to the author's statement that it was an easier problem to have town gas or oil engines running in parallel than to have producer gas engines running in parallel, he was not clear why this was so. It was stated that the producer gas was not so consistent in quality. If the gas varied in quality, however, it would vary for all the engines in the station at the same time. The author had given most excellent reasons for the adoption of horizontal engines as against vertical. In fact, the reasons were so good that one wondered why anybody went in for vertical engines at all; but the fact remained that they did. Therefore, there must be some aspect of the problem which he had omitted. As a matter of fact one generally considered gas engines as being horizontal, but the Diesel engine or the heavy oil engine was generally made vertical. Why was this the case? It was stated in the paper, with regard to convertible gas and oil engines, that the power developed remained the same when using town gas or oil as fuel. He considered producer gas might have been added. Among the additional parts required to make a town gas engine convertible to oil, the author had mentioned a special piston, to give a higher compression pressure. He (Capt. Sankey) did not see why, unless there was a great difference in the compression, the extra compression could not be obtained by the easier method of altering the length of the connecting rod. The author had given the fuel cost per unit of electricity generated, using town gas, as 0·756d.; and he asked whether the engine was working at full load.

Mr. WALTHEW replied that it was working at half-load.

Capt. SANKEY said this meant that the economy per B.H.P. was considerably worse than it would be at the full load. He assumed the author had taken this into account.

Mr. G. BEER presumed the author was dealing principally with towns where a supply of electricity was being inaugurated, and did not advocate building a new gas-driven station to replace an existing steam-driven one, or one receiving a bulk supply. With regard to gas engines, he had not had the same results with suction producers as the author had claimed in respect of fuel costs per unit generated; and it was also found that more stand-by was necessary as compared with steam stations. With regard to the table in the paper, he regarded the load factor of 25 p.ct. as too high. The figure of 4d. per therm for town gas was extremely low. He had taken out figures in regard to a gas undertaking comparable in size with the one the author had in mind, and had found that the actual cost of gas into the holder, after deducting residuals, was about 9·8d. per therm. At this figure, the fuel cost per unit generated amounted to 1·85d., as compared with 0·756d. given in the table. Adopting a load factor of 20 p.ct., instead of 25 p.ct. (20 p.ct. being usual for stations of about 1000 KW. capacity), and making a correction for this, he found the total works cost per unit, using

town gas engines, 2·345d., as against the author's 1·149d. The attendance costs, using town gas, of £13 per week, seemed extremely low. He asked for information as to the results achieved in the gas-driven electricity stations mentioned in the paper, the price paid for gas at Crowborough and Swanage, and the rates charged per unit for electricity.

Mr. T. E. DAN referred to the obsession with regard to super-power stations, and the necessity for treating districts on their merits. With regard to a bulk supply of electricity, unless the people who had proposed to supply Essex had made a very big mistake in the figure at which they were going to supply Chelmsford, it was not a proposition that could be touched, because the figure was much higher than that at which electricity was supplied to ordinary manufacturers in (say) the district supplied by the Newcastle Electric Supply Company. In the Chelmsford area there were three towns within twenty miles of each other with their own gas undertakings. The Chelmsford undertaking had a capital of £109,000; Colchester had nearly double the output and one-third of the capital outlay, due to the fact that the town had been modernized; Brentwood, with a slightly less output than Chelmsford, had a capital cost in the neighbourhood of 50 p.ct. of that of Chelmsford. If the author had taken the figures at Chelmsford, his application would have been wrong, but this did not alter the fact that in any community public service counted for something. If they combined the two undertakings, there was already in existence a selling and distributing organization, and economy could be effected. A meter reader, for instance, could easily read the electricity and gas meters at the same time, and the costs on the accountancy side would not go up appreciably. As to the supply itself, combination would also help. In the ordinary household, gas was undoubtedly the best thing for cooking; and they could not hope, in such a small town as Chelmsford, to make electricity so cheap that they could use it for cooking. At the Ideal Homes Exhibition they would be able to see a home in which everything was done by electricity, and which required nearly the output of a power station to supply it. On the other hand, electricity was used widely for lighting. The two ran together, and there was every reason why the gas and electricity stations should be combined in thinly populated areas. The area around Chelmsford was such that the practice of putting down gas engines to generate electricity at different points, to save the cost of laying electricity mains, could be adopted.

Mr. G. BASS, discussing the reliability of gas engines, referred to six 500-H.P. Premier gas engines running on producer gas, which had proved to be very reliable. The total hours run since installing were 124,468, the units generated were 32,155,419, and the compulsory stoppages totalled 121¾ hours. One set had run 12,202 hours, and the exhaust valves had not been ground-in. As an experiment, they were made of stainless steel, and had been very satisfactory so far. During the last run of 4000 hours, the gas valve or inlet valves had not been looked at, and this spoke well for bituminous gas producer plant.

Mr. H. B. TILLEY said there had been talk in Chelmsford about the electricity supply being taken over by the Corporation, and possibly the idea was to consider whether they should not try to supply electricity from the gas-works. He could not understand anyone putting forward a proposition in a town of that size to drive a gas engine by town gas for generating electricity, except to increase the demand for gas and reduce the price. The cost of manufacturing gas would have to be brought down to a lower figure before it would be economical. It was efficiency and economy which had to be considered. Electricity was supplied in Chelmsford at a periodicity of 100 cycles, which was no good for power, and a 3-phase 25-cycle or 50-cycle supply would be better. The figure of 4d. per therm for town gas, mentioned in the paper, seemed absurdly low to those in Chelmsford. Though at Newcastle electric power could be supplied at about ⅜d. per unit, and at Manchester at about ½d. per unit, he concluded that the price of electric power would not be anything like that if town gas were used for generating electricity. The fusion of town gas and electricity supply was a problem which called for very careful consideration before it was adopted.

Mr. J. H. JOHNSON said it was all very well to talk of generating costs, but this did not concern the user, who had to take into account the charges for transmission and service. He concurred with the author and Mr. Seabrook as to the advantages of combining gas and electricity stations, but it must be realized that competition was thereby eliminated. As to the generating of electricity in super stations, it was up to the individual concerns to satisfy the actual users as to whether this was the best course. If a concern could generate electricity itself at a lower cost, and supply at a lower price, it should obtain powers to do so, and should not be forced to take power from the larger concern. With regard to fuel, within a few miles of Chelmsford there were installations working on waste fuel, including sawdust and waste wood; and the generating costs of these stations, which supplied public as well as private needs, were extremely low. Bye-products also were a considerable item in increasing the efficiency of the plant. With regard to the table, and the capital cost of the generating plant, using town gas, producer gas, and oil engines, he asked whether, in the case of the town gas and producer gas driven generating plant, allowance had been made for the cost of the additional gas-making plant to supply the engines. If not, such an allowance should be made, when comparing gas engines and oil engines for generation purposes. As to horizontal *versus* vertical engines, he considered the author was not quite fair in pointing out that the cost of buildings was less with horizontal than with vertical engines, owing to the buildings being higher for vertical engines. The height of buildings was not a matter for consideration when speaking of such small engines as had been referred to in the paper. There were many successful vertical engines running, both on steam and oil.

Mr. H. J. GIBBONS (Director of the Premier Gas Engine Co., Ltd.), speaking of super-generating stations, said the advice was often given in financial circles not to put all one's eggs in one basket. And it seemed to him very often that when these big super-stations were advocated in the Press—and he was sorry that it had become a political and journalistic controversy—there was something to be said for similar advice. For one thing, we had not yet passed the age of labour troubles; and they all knew what a few men could do with a big super-station if they decided to throw it out of order. If that time came, it would mean a good deal of industrial dislocation in the Midlands and the North. Therefore, the small station had some claim to consideration on this ground. Referring to Mr. Bass's remarks as to the reliability of gas engines, he said there were many instances of gas engines running continuously, under very severe conditions, for many months without a stop. As to the height of buildings as a consideration when installing vertical or horizontal engines, he referred to an instance in which two horizontal sets had been installed in an existing building, where vertical sets could not have been installed. Floor space was not the only consideration, except, perhaps, in very crowded places; and in the instance referred to, several thousand pounds were saved by utilizing existing buildings. As makers of both horizontal and vertical engines, his firm, if asked for advice, were unhesitatingly in favour of the horizontal. It was more economical, both in fuel and lubricating oil; and when it came to accessibility, he did not think there could be two opinions.

Mr. C. S. BUYERS said the paper divided itself into two different propositions—namely, cheap power production, and the question of whether it was suitable for Chelmsford to run an electricity plant with gas. As to the first, the author had stated that the question of whether it was an economical proposition to generate electricity on a large scale by using town gas engines as power units would doubtless call for a good deal of criticism. He himself considered the author very kind to the gas engine, because it was out of the question for generating electricity on what was called a large scale. He asked what was the largest size of town gas engine at work in this country. For the 1000-KW. generating station the author had taken a plant comprising four units of 250 KW. each, and this made him (Mr. Buyers) think that a 250-KW. unit was the largest the author liked to tackle for town gas. He himself would imagine that for a 1000-KW. station it would be better to have three units each of 300 KW., and one of 100 KW., the latter to deal with the night load, because it was not economical to run a 250-KW. set all night on a 100-KW. load. With regard to a gas engine which could be converted to run with oil, he asked if anything was sacrificed in making it convertible. He agreed that at Crowborough, with a small load spread over a large area, it was an ideal case for combining gas and electricity supply; but when they came to electricity stations with a 500-KW. maximum load, this could not be left under the supervision of a gas engineer. A point must be reached at which it was necessary that the gas and electricity undertakings should have their separate heads. Meter-reading, accountancy, &c., could, of course, be carried out by a joint staff. In his opinion, the electricity undertaking at Chelmsford was rather too big to put into a gas-works. It would be advantageous, perhaps, to have the electricity station a short distance from the gas-works, and supply gas for generating, each station having its own staff and chief engineer, and to have the commercial side of the business dealt with jointly; but it would be a doubtful experiment to put two stations of this size under one head. Referring to the Sheffield Gas Company, he said they had installed, at the Neepsend station, a 250-KW. Crompton-Premier set, but at their other station they had put in a Crompton rotary converter and a balancing steam set. It would be interesting to know why the Company should have put a gas engine at one works, and at the other a rotary converter with town supply; they were buying current from the local authority, and the gas and electricity supply were not under the same control. It seemed to him that there was very little between the two; otherwise the Company would have had rotary converters or gas engines in both cases.

Mr. WALTHEW, replying to the discussion, said the 4d. per therm which he had assumed as the price of gas supplied to the gas engines, had been confirmed by a friend at a large gas-works at Manchester as being a fair price. The whole point about using town gas in a combined station of this sort depended entirely on a reasonable price for gas, and the town gas suppliers must realize that this was a good opportunity of making good the loss of consumption in other directions. They had to face the problem of producing cheaper gas. The oil engine to-day would give power at a price equivalent to that of the gas engine using town gas at 1s. per 1000 c.ft. As to the statement that it was not so easy to run on producer gas as on oil or town gas when working in parallel, he said this was because the thermal value of producer gas varied. This variation could be dealt with; but if they were going to have parallel running, they must have a means of making the variation as small as possible. This could be done by having a holder, as with town gas, or having very large pipes. It had been stated that, inasmuch as the variation would take place on all the engines, it would not matter; but this was not the case. With regard to the need for the special piston being required when making a town gas engine convertible to oil working, he said that a special piston to give 350 lbs. pressure was necessary with an oil engine suitable for this type of work, whereas with producer gas it needed to give only 150 lbs. It was his experience that the conversion could not be done by altering the length of the connecting rod. In reply to Mr. Beer, he said he did advocate building new stations to give a supply of electricity where the demand justified it. As to the load factor of 25 p.ct. being too high, he said he had chosen an average. The generation of electricity with gas at 9d. per therm was, of course, out of the question.

At this point, owing to shortness of time, Mr. Walthew intimated that he would reply in writing to the remainder of the points raised.

Gas-Fired Furnaces.—Mr. S. A. Sears, B.Sc., Chief Engineer to the Selas Gas and Engineering Company, Ltd., is delivering a lecture on "Gas-Fired Furnaces" at Sheffield University, on Monday, the 23rd inst.

MANCHESTER DISTRICT JUNIOR GAS ASSOCIATION.

Visit to Messrs. R. & J. Dempster's Works, Manchester, Wednesday, Feb. 4.

About seventy-six members of the Association visited the works of Messrs. R. & J. Dempster on Wednesday, Feb. 4. They were received at the offices by Mr. C. Dempster (Chairman), Mr. H. S. Knight (General Manager), and Mr. J. W. Scott (Consulting Engineer).

TOUR OF THE WORKS.

The visitors were first conducted to the large foundry, where all classes of castings, from a few ounces in weight to seven or eight tons, are made. They inspected miscellaneous collections of pipe-work, including cast-iron superheater pipes, cast vertically, and a top-tube-plate for one of the firm's vertical condensers. A Weck valve body casting just lifted from the sand, having been cast the previous day, proved very interesting. The party then passed through the planing shop, where heavy castings and all purifier plates are planed. The visitors were shown the means adopted to ensure accuracy in machining. In the fettling shop adjoining they were able to see all kinds of castings in the rough and finished state.

The fitting shop contains over 300 lathes and machines of different descriptions. Passing through the machine bay they inspected the liming tank and a sulphate of ammonia still in course of construction, also a Feld washer casting and Hovey crane. The various types of "Bearscot" gasholder carriages proved interesting to most of the visitors. Several hundred of these were in course of construction. The tackle stores was next inspected, and when the visitors were told that the firm have at times as many as 40 to 50 contracts running, the importance of this building and the various tackle was appreciated. The boiler shop, which has recently been entirely rebuilt, consists of six bays, each 60 ft. span by about 300 ft. long.

In the first bay were seen various operations of electric welding, which is now utilized extensively in gas plant construction. In the adjoining bay the visitors were shown a sheet stretching machine, by which gasholder sheets are straightened and examined before being sent away, and a multiple punching machine in which as many as 100 holes can be punched simultaneously. Attention was also drawn to a powerful hydraulic press in which some "Bearscot" vertical stays were being pressed; and flanges for large holders were being heated and bent. Passing through the next bay the visitors inspected a large battery of Asquith drills, a plate edge planing machine, &c. In the next bay annular condensers, steel tubes, inlet and outlet duckfoot bends, &c., were being assembled.

The compressor pump house was next inspected, in which are fixed three compressors and one set of hydraulic pumps for supplying the necessary power to the various parts of the works.

The visitors were afterwards entertained at tea, prior to the meeting, which was held in the Recreation Room.

Mr. BATTERSBY (Bury), in moving a vote of thanks to the Directors for their cordial reception, said it was about nineteen years since they paid their first visit to those works; the occasion being the first meeting of the English Junior Gas Association. They had seen all types of plant in process of construction, and had been surprised at the magnitude of the works. He expressed the thanks of the Association to the Directors and to the guides.

Mr. APPLEBEE (Manchester) seconded this vote.

Mr. DEMPSTER, in reply, said he remembered the last visit, some nineteen years ago. The firm were always pleased to have the criticism of gas engineers, for they were enabled, by working together, to get the best results. It might not be known to the members present that they had made exhausters of 2,000,000 c.ft. capacity which had been running continuously for thirty years.

Mr. KNIGHT also remarked upon the utility of criticism. He mentioned the courtesy the firm had received from various gas undertakings from time to time. The least they could do was to extend to the gas profession the same courtesy they had themselves received.

Mr. A. D. YOUNG, M.Inst.Met., of Burnley, then read the following paper on

THE DESIGN AND CONSTRUCTION OF A GASHOLDER TANK AT BURNLEY.

Prior to 1914 the Gas Committee of the Burnley Town Council were on the look-out for a suitable site for the construction of an entirely new gas-works. The present works are situated in the centre of the town, and have no storage accommodation. The gasholder station is about half-a-mile distant from the manufacturing plant, to which it is linked up by two trunk mains 30 in. and 18 in. in diameter respectively. The storage plant at the holder station consists of four gasholders, the total capacity of which is 2,500,000 c.ft.

Up to December, 1922, the maximum daily consumption was 3,900,000 c.ft., giving a storage ratio to the maximum consumption of 64 p.ct. The Gas Committee therefore decided to purchase a site on the edge of the town, at which both railway and canal facilities could be secured, and to proceed at once to construct additional storage accommodation. In order to gain access to the site, it was necessary to construct a road 350 yards in length from the nearest street, bridge a colliery tramway, and culvert two streams. The most level and best portion of the purchased land lay at the south end; and a fault in the coal measures ran parallel to, and not far away from, the west boundary. The land in the northern portion of the site had a very varied contour, and provided much space for tipping.

Trial core borings of the site showed that the subsoil was composed mainly of different clays. From observations in the neighbourhood, it was known that the clays near the surface were of a very treacherous nature. Constant packing of the railway embankment at the east boundary, and the constant patching and repairing of an occupation road near by, are the results of an overloaded subsoil, which, during damp weather, has a tendency to squeeze out and let down the load placed upon it. In such circumstances it will be understood that the position selected for the gasholder tank was such that the construction should be in the best ground obtainable on the site. In order to provide for a holder of 3 million c.ft. capacity, three proposals as to design were considered:

1. A tank 180 ft. in diameter by 45 ft. deep, containing a three-lift holder.
2. A tank 180 ft. in diameter by 33 ft. 6 in. deep, containing a four-lift holder.
3. A tank 160 ft. in diameter by 36 ft. deep, containing a five-lift holder.

Rough estimates were taken out to find the probable cost of each scheme, and consideration was given to the holder in relation to the general lay-out of the works, road, and railway sidings. Scheme No. 3 was finally decided on; a strong point in the decision being that much less deviation of the road through the works was caused by the adoption of a 160 ft. diameter tank.

The possible types of construction under consideration were:

1. Steel tank above ground.
2. Brick, masonry, or concrete tank below ground.

The ground on the site of the work had a material fall from east to west of about 8 ft., and was of a very soft and marshy character near the west border. A shallow pond about 30 ft. in length by about 12 ft. wide had formed on the west side, due to the contour of the ground and the backing-up of water into the field drains from the stream at the west boundary of the land. In consequence, a large cost would have been incurred in piling and levelling-up the site to make it suitable for a steel tank above ground, also a costly foundation raft would have been necessary to distribute the load of the tank and contents so that the load on the subsoil would not exceed the safe bearing pressure which the material would carry at a moderate depth. Further, many thousands of cubic yards of soil were required for the making of high level railway sidings to the coal stores. These factors, together with the cost of upkeep and comparatively short life of steel tanks compared with brick ones, decided the question in favour of a tank of the below-ground type.

The design of tank having been decided, the choice of the materials of construction then became the immediate question. The alternatives were brick and puddle, mass concrete, and reinforced concrete; and before the choice could be made, further attention to the subsoil was necessary. From various banks it was found that the angle of repose of the clay, where subject to moisture and when standing in banks up to 15 ft. in height, varied from 40° to 50°.

An examination of the dried samples from the boreholes showed the dried clay to be of an unstable character in excess of water, the material falling to slurry in a few seconds. As a material for foundation, the virgin clay will sustain heavy loads, provided excess of water is not present. The material forms a fair quality of puddle, if well confined and not oversaturated with water. Certain slow movements of the land round about were known to be taking place in a direction towards the west; and these, coupled with the slow subsidence, due to the completion of mining operations under the site, demanded that every precaution should be taken in order that the tank when completed should be free from cracks.

The breaking loads of a series of test arches loaded to destruction in Austria a few years ago were as follows:

	Tons.
Brickwork arch	67·5
Masonry arch	74·02
Plain concrete arch	83·27
Reinforced concrete arch	146·12

The elastic moduli of the materials of construction calculated from the above results were:

	Lbs. per Sq. In.
Masonry in cement mortar (2 6 to 1)	850,000
Brickwork " " "	400,000
Plain concrete	3,500,000
Reinforced concrete	4,700,000

The weakness of a brickwork tank is that, should any great inequalities of pressure fall on the inside face owing to failure of the earth backing to take up the pressure from the tank wall after filling with water, vertical cracks may be formed. Again,

should tension come on to the brickwork, the mortar joint is always the source of weakness, due to its low strength in tension or low adhesive strength. It is necessary that a tank constructed in brick should be provided with an outer backing of clay puddle, to ensure tightness against hydrostatic pressure; brickwork alone being too porous for the purpose in most soils. In cases of slight settlement, the elasticity of the clay puddle will often save a brick tank from leaking when small cracks have appeared in the brickwork; but a brickwork tank cannot be classed as a monolithic structure, in spite of the brickwork bond.

In the case of reinforced concrete, the contractors who approached us preferred that the tank wall should actually be built in a number of vertical sections, each section being more or less complete before the next was commenced. This procedure is, of course, economical in the amount of timber required for the trench and shuttering, as the timber may be used over again a number of times after cleaning. In such a structure the continuous bond is obtained by the horizontal reinforcement, but the possibilities of poor adhesion of section to section, due to dirty joints, is, to my mind, a source of weakness in constructions carried out in a clay subsoil, unless each surface is washed and hacked clean before further concrete is added. Hacking-off is necessary, as adhering clay is almost impossible to wash off. The loosened material should be thrown away. We were informed that sufficient steel would be put into the structure to take all the tension in the wall due to the water load, which meant that bars at about 3-in. centres would have to be adopted. Under such conditions it was not thought that the structure could develop its maximum strength, owing to defective adhesion of concrete to steel, which might occur with bars at such small centres, for the concrete could not be rammed into place without risking accidental displacement of the steelwork. Displacement considerably alters the stresses which the reinforcement has to meet. It was also thought that there was little likelihood of obtaining a truly circular tank by such a method of construction, considering the nature of the ground and the probabilities of a wet season. Further, though Burnley is in a good stone district, bricks command a good price, and it was felt that the local quarries would have small stone for disposal suitable for concrete at a low cost. The above factors therefore decided us in favour of a tank constructed in mass concrete, and having all the monolithic properties of a reinforced concrete tank.

When considering the design of the tank wall, attention was given to the published records of previous tank constructions in clay and other materials; but the information so gleaned was not of a character to enable us to take out a design capable of giving a maximum strength with a minimum of cost. Formulæ for earthwork pressures against retaining walls failed to give us any definite guidance, because:

(i) They take no account of the friction between the wall and the earth backing when movement takes place.
(ii) They suppose the backing to consist of an incompressible homogeneous mass, granular, and without cohesion, the particles being held together by friction.
(iii) They presuppose a knowledge of the angle of repose.

The first objection could be surmounted, but the second and third were more difficult. Clay cannot be considered to be a loose granular mass without cohesion; and the angle of repose *in situ* is totally different from that of excavated clay. This angle probably depends on the pressure, moisture content, stratification, and physical and chemical characteristics of the material.

The works of Sir B. Baker, Bell, Crosthwaite, and others on the lateral pressure of clay were examined in an attempt to find a law to which the cohesion of clay would conform; but without success. It was necessary to fix on a suitable angle of repose before any graphical work could be undertaken; and after consideration, this was fixed at 40°. The Rebhann and Haseler earth-pressure diagram was used to obtain the thrust due to the earth backing. This construction has been largely adopted in Germany, Austria, and Switzerland, and has given results which have proved thoroughly satisfactory in practice.

Design of the Tank.

Gasholder tank walls are usually subjected to the heaviest stresses before the tank is filled; and the designer must give consideration to the stresses in the wall and the resistances of the earth backing of the tank when either full or empty. At a depth of 42 ft. below the tank coping there is an inward thrust of about 727 lbs. per sq. ft., due to the earth backing. There is also an outward thrust of about 1464 lbs. per sq. ft., due to the water when the tank is filled. The net outward pressure with a full tank is therefore 737 lbs. per sq. ft. At the bottom of the tank the earth pressure is about 964 lbs. per sq. ft., and the water pressure 2227 lbs. per sq. ft. The net outward pressure with a full tank is therefore 1263 lbs. per sq. ft.

The actual stresses occurring in the material of the wall at any point will depend upon whether the tank is full or empty, whether restraint is exercised by the foundation ring, and whether the earth backing is fulfilling its function. Small deformations of the wall will occur when under stress, and will be proportional to the forces causing them, and to the elasticity of the material. Taking the elastic moduli of concrete in compression and tension at 3,500,000 and 350,000 lbs. per sq. in. respectively, and assuming the wall to be 4 ft. 6 in. in thickness, when the tank is empty there would be, at a point 24 ft. below the coping, a compression in the concrete of about 13,650 lbs. per sq. ft. When the tank is full, the tension in the concrete due to this outward thrust is 13,100 lbs. per sq. ft. Under this tension the increase in radius would be 0·021 ft., which is well within the compression limit of the clay at the load stated. At the bottom of the tank the results would be as follows (neglecting restraint of foundation ring):

Compression in wall (tank empty) . . .	18,100 lbs. per sq. ft.
Tension in wall (tank full)	22,454 ,, ,,
Increase in radius due to above stress . .	0·036 ft. = 0·43 in.

This increase in radius of the tank would be greater than the penetration of stiff boulder clay under similar load, and the clay backing will safely withstand the load from the tank wall. The stresses in the concrete are also within the limits of the strength of the material, providing the clay backing will take up the load from the wall.

It was desired that the concrete wall should be placed up to the virgin clay for the bottom 13 ft. 10 in. of its height, in order to obtain a sound, undisturbed backing. The upper two-thirds of the wall could be reduced in thickness to a minimum at the coping, as the stresses were decreasing. Practical considerations were, of course, kept in view throughout the design, and the tank wall was therefore made 37 ft. 9¾ in. deep, by 4 ft. 6 in. to 2 ft. 6 in. in thickness. The material was specified to be proportioned as follows: 27 c.ft. of ballast, 10·80 c.ft. of sand, and 486 lbs. of Portland cement.

Twenty piers 5 ft. wide by 5 ft. long were arranged round the circumference of the tank wall to take the standards of the gasholder frame. As the site is very exposed, and high wind pressures are experienced, it was felt that, with a guide frame reaching to a height of 170 ft. above the tank, the loads falling on to the tank wall should be as evenly distributed as possible. The twenty piers thus arranged were not too liberal an allowance in this particular case.

Should the clay prove practically homogeneous throughout, the stress on the concrete covering the dumpling would be small in amount, assuming the correct angle of repose to have been taken. This concrete could therefore be of a much weaker consistency than that proposed for the tank wall; and a mixture of four parts of ballast, two parts of sand, and one part of blue Lias lime was proposed. A cement concrete proportioned as to 27 c.ft. of ballast, 10·8 c.ft. of sand, and 408 lbs. of Portland cement was subsequently substituted for the Lias lime concrete. The angle of the cone was struck at 40° from the horizontal after allowing a floor 8 ft. in width for the placing of rest blocks. In order that the holder would supply our station at Stoneyholme with gas when it contained less than one lift, it was decided to put trussing into the holder, and no wood frame into the tank. A circular pier 6 ft. 9 in. in diameter, and a foundation block were therefore arranged in the centre of the tank, and forty sets of tank guides were arranged round the tank, one at each pier and one midway between the piers. Forty rest blocks were arranged in the bottom of the tank in positions between the piers.

The tank coping between the piers was formed of blue bricks set in cement mortar, and is 2 ft. in width by 6 in. deep. As a precaution against leakage through porous concrete, a ¾-in. rendering of cement mortar on the interior was arranged. The first coat was ½ in. thick, and composed of 2 to 1 cement mortar. The final coat was composed of 1 to 1 cement mortar.

Choice of Methods of Construction.

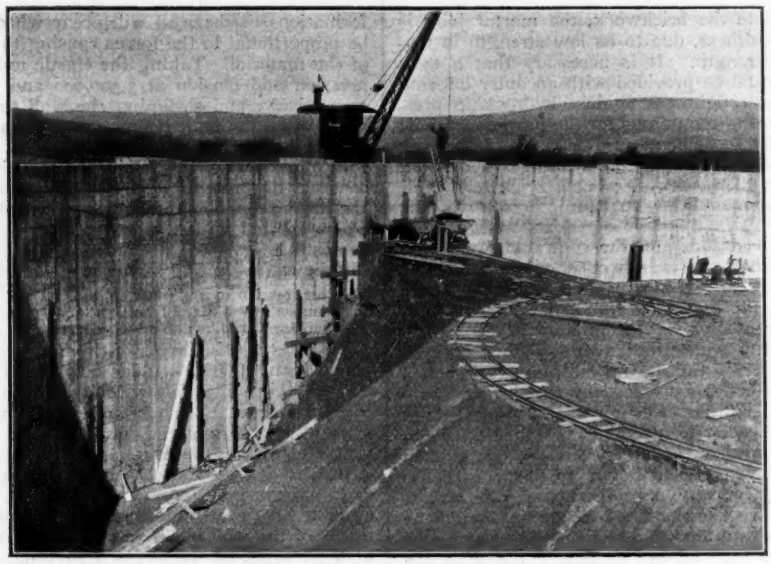
The contractors were given a free hand to use their own methods of construction, provided that the tank wall was first constructed and the dumpling taken out and concreted after the wall was finished. They therefore had the choice of plant to suit their purpose. The alternative methods open to them for the excavation of the trench were:

1. Radial travelling grabs working on the exterior of the trench.
2. Radial travelling cranes with loose skips or jubilee wagons working on the exterior of the trench.
3. Fixed long jib cranes working in conjunction with jubilee wagons; the cranes being fixed at points exterior to the tank wall.
4. Radial travelling cranes working on the interior of the tank.

The contractors chose the second method, as it had the advantage of being in every way suitable for the removal of the spoil from the dumpling with practically no re-arrangement of plant.

Excavation.

The construction commenced by taking off the turf and top soil from the whole area. A trammel bar consisting of a cast-iron vertical pillar, provided with a baseplate and turned bearings, together with a trussed horizontal bar of steel joist, was



PLANT FOR CONSTRUCTING THE DUMPLING, SEEN UNCOVERED.

erected on a concrete base block in the centre of the tank, which had been previously set out from a measured base line. The inside and outside line of the annular trench were then marked out on the ground. A shallow trench was cut on the east side of the tank to cut off the field drains which otherwise would discharge their contents into the excavation. A datum peg, from which all levels were to be taken, was fixed up; this being frequently checked during the progress of the work. The method of making the excavation and handling the excavated materials adopted by the contractor was as follows.

A circular railway track of standard gauge and about 90 ft. radius was laid round the annular trench for the travelling cranes. Exterior to this track a further track of 18-in. gauge was laid at a radius of about 100 ft., for the disposal of excavated material by jubilee wagons hauled by a small steam-driven locomotive. The track was provided with two loops at the north-east side, by which excavated material was hauled away for the making of a high-level bank for works sidings. About 25 jubilee wagons, each of ¾ cub. yard capacity, were in use for the haulage of the excavated material, and two steam cranes were used for lifting the material from the trench. The empty wagons were brought to the travelling crane; the skip being picked up from the carriage by the crane, and dropped into the trench. When the wagon was filled, it was picked up by a sling chain attached to the crane rope, hoisted to ground level, and placed upon its truck; an empty wagon being dropped into the trench for filling. Six to eight full trucks were collected to form a train load, and the wagons hauled up to the spoil dump, where they were emptied.

The upper clays were of a fairly soft nature; but after a depth of about 15 ft. had been reached, the boulder clay was found to contain many pebbles and large boulders. Beyond this depth the material was very hard to work with a clay tool, and picks were often necessary. This, together with a wet season, slowed down the progress of the work and allowed the elements ample time to act on the sides of the trench.

It was expected that the contractors would timber the trench by internal frames, each about 13 ft. deep; but in order to save excavation they decided to cut a straight trench. This had a width of 8 ft. 10 in., and was timbered by 7 in. by 7 in. pitch-pine struts placed about 4 ft. centres. The walings were of 9 in. by 3 in. pine, and the poling boards 1½ in. thick. As the excavation proceeded, the timbering was found to be on the weak side, and 8 in. by 8 in. struts were substituted in the lower depths; all the struts being respaced at closer intervals. A firm and hard trench bottom, suitable for the base of the wall, was obtained at the required depth; and no further foundation or piling was necessary. When the trench bottom was reached, it was found, on checking the depth and diameter, that the outer radius at the bottom of the trench was only about 84 ft., instead of 84 ft. 6¾ in. A number of struts and walings had had to be replaced, due to crushing of the timber in the lower two-thirds of the depth, and the sheeting was certainly on the weak side. Alternate wet and dry weather had caused the clay sides of the trench to swell; and this, together with the earth pressure and weak sheeting, was the cause of the reduced radius. Before any concrete could be deposited in the trench, it was necessary that the excavation should be cut back to the proper radius. This work was done between the periods of placing the rings of concrete; the cut-back portion being kept one ring in advance of concreting operations.

The excavation being in boulder clay, no large amount of water other than surface water was expected. This expectation was justified; and a pulsometer pump was capable of dealing with all the water found in the excavation, without much delay to the work.

PLANT AND MATERIALS FOR CONCRETE MAKING.

A cement store of about 60 tons capacity was erected near the railway company's sidings, and a ballast dump was laid out near by. Stone breakers, measuring hoppers and boxes, and concrete mixers, each of a capacity of ½ c. yard, were erected in duplicate near to the cement store and ballast dump, to which they were linked up by the 18-in. railroad. The concrete mixers were linked up by this railroad from the tank, so that mixed concrete in skip-loads could be sent down by gravity. The ballast, as approved by the gas engineer, was mis-shapen and overburnt brick obtained from a brick manufacturer noted for the hardness of his product. After breaking, this gave the following result on testing:

Percentage of voids on a 5 c.ft. sample = 39·3

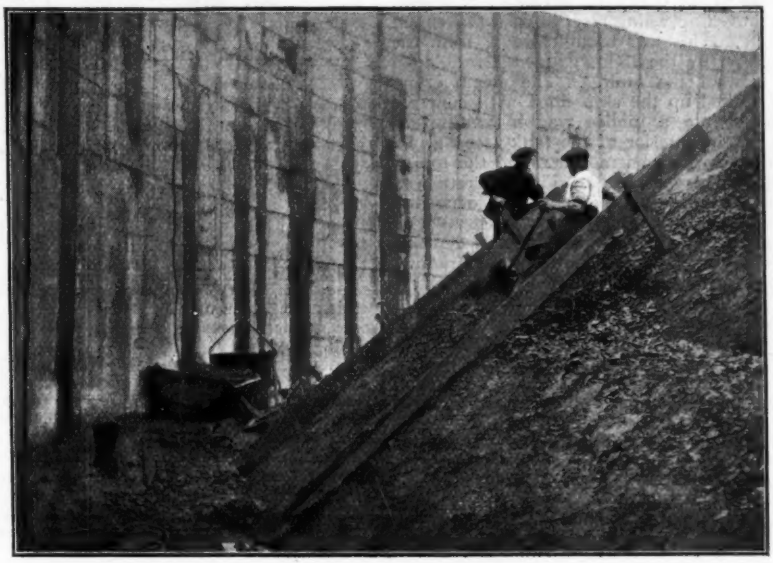
SIZING TEST.

Volume of ballast taken	=	1·9 c.ft	
Material over 1 in. mesh	=	52 2	p.ct. of above
,, ,, ⅞ in. ,, and under 1 in.	=	12·66	,, ,,
,, ,, ¾ in. ,, ,, ,, ⅞ in.	=	13·2	,, ,,
,, ,, ½ in. ,, ,, ,, ¾ in.	=	13·2	,, ,,
,, ,, ½ in.	=	21·45	,, ,,
Volume of ballast as separately sized .	=	2·135 c.ft	

A constant watch was kept on the sizing of the ballast and its quality; any soft material being rejected. The sand employed was clean, sharp pit sand obtained locally; and this material was frequently tested for earthy matter or clay. The cement was used without any aeration after arrival on the site; the makers giving a guarantee with each consignment that the cement had been air-cooled before delivery. Every consignment was sampled for testing on delivery, and no cement was used until the 7-day tensile tests were completed. The 7, 14, and 28 day tests were frequently compared with those made by the manufacturers, and in every case the material was well above the British Standard Specification, the tensile limits of which should now be raised, owing to fine grinding and improved methods of manufacture. The only trouble experienced in the mixing of the concrete was a tendency for the contractor to send down concrete made up in too wet a mixture, as this is much easier to place than a stiffer mixture. Very wet and very dry mixings result in weak concrete; and this is more intensified in the case of wet mixings. In the near future it is very probable that the weight of water to be used will be specified for concrete mixtures in a similar manner to the weight of cement, in order that the designers' calculated figures for strength may be more nearly realized. The following cement tensile tests have been picked out at random from the test results:

Particulars. Sample No. 15.	7-Day Test.		28-Day Test.	
Residue on 76 by 76 mesh, 0·73 p.ct. ,, ,, 180 by 180 ,, 4·22 ,,	Neat Cement.	Cement 1, Sand 3.	Neat Cement.	Cement 1, Sand 3.
Area of briquette, sq. in. . . .	1	1	1	1
Weight of water, p.ct.	20	7	20	7
Initial set, minutes	55	—	—	—
Final set, ,, ...	190	—	—	—
Immersion in water, days . . .	7	7	28	28
Expansion (B.S. Spn. 10 m/m) .	1 m/m	—	—	—
Average breaking stress (6 specimens), lbs. per sq. in. . . .	715	329	781	386

NOTE.—Sand passed through a 20-mesh and retained on a 30-mesh sieve.



CONCRETING THE DUMPLING.

CONCRETING THE TANK WALL.

On reaching the bottom of the trench, the 1 ft. 6 in. thick annular ring of concrete was placed in position after withdrawing the sheeting on both sides of the trench for a height of about 2 ft., and cutting back the clay on the outer side of the trench. Forty vertical timber posts were then placed in position on the foundation block, to carry the sheeting for the interior face of the tank. This sheeting was built up on rectangular frames about 4 ft. in length and 3 ft. in depth; the frames being curved to the tank radius in plan. The frames were bolted up to each other and to the vertical posts in the bottom of the trench, and the posts were well braced to the timbering on the inside of the trench. The circle of sheeting was finally checked by the trammel for accuracy of diameter. The timbers on the outer side of the trench were drawn for a height of about 3 ft., the earth backing trimmed off to the correct radius, the foundation block swilled and brushed down, and concreting of the first ring commenced. The foundation block and the first four rings were thus placed with the concrete right up to the clay backing on the outer face of the wall, to ensure actual contact between the two materials. Barge boards were used at the commencement and finish of each day's work, so that loss of cement from the fresh deposited concrete should not occur. The rings of concrete 3 ft. in depth could be deposited in two days, and a further period of three days was allowed for setting before preparations for the next ring were made. The concrete was trodden into place, well spaded back from the timber sheeting on the interior side, to obtain a good face, and worked up to a creamy top by the shovel. As the contractor was already some months behind with his work, it was decided, instead of battering the exterior face of the wall for the upper portion of its height, to construct this portion with a series of horizontal set-offs. This procedure enabled the contractor to utilize timber forms for the exterior of the wall as well as for the interior, and avoid delay in waiting for timber for sheeting the exterior face.

As the concreting of the tank wall progressed, the timber behind the wall was drawn, and the cavity between the back of the wall and the earth filled with clay from the excavation. This filling was put into place as the wall increased in height; care being taken to keep about 4 ft. below the concrete. The holding-down bolts and anchor plates were placed in position in the piers, and concreted in place as the work proceeded. The holding-down bolts are 2½ in. diameter, 15 ft. in length, and were thickened up at the thread to 3 in. diameter. The bolts were buried in the tank wall to a depth of 13 ft. 9 in., and were surrounded by tapered wood bolt boxes, which were broken out when the tank wall was completed. The piers of the tank wall were carried up to the level of the top of the tank coping, and the portion of the wall between the piers was finished off at a depth of 6 ft. below the top of the coping; this portion afterwards being filled in with a coping of 2 ft. by 6 in. deep blue brick set in cement mortar. A cast-iron overflow box was also fixed.

EXCAVATION OF THE DUMPLING.

The ground in the interior of the tank was excavated by hand to within 1 ft. of the top of the proposed dumpling. The spoil was filled into jubilee wagons running on a track placed in the interior of the tank, the position of which was moved at intervals to suit the excavation. The filled wagons were run to the edge of the excavation, picked up from their trolleys by the cranes, placed on waiting empty trolleys on the 18-in. railway outside the tank, and hauled to the tip; empty skips being dropped in their place. A central mound of earth supporting the trammel was left in the excavation until the concreting of the dumpling was practically finished. When a depth of about 9 ft. 6 in. below the tank coping had been reached, excavation for the sloping sides of the dumpling was commenced, except for a strip about 30 ft. in width at the west side. The excavation was done by hand; spoil being filled directly into the skips, which were hoisted by the cranes on to waiting wagon trolleys on the 18-in. gauge railway outside the crane track. The dumpling was thus gradually worked down roughly to shape in a series of terraces or steps; the strutting timber and sheeting left in the annular trench to support the tank wall in its green state being removed as the excavation proceeded. On the bottom of the tank being reached, excavation was temporarily suspended on the dumpling.

Meanwhile, excavation had been proceeding behind the tank wall for the inlet and outlet pipes. This was now finished off inside the tank, and the tank wall undermined at two points for the horizontal portions of the pipes. The pipes, which are 30 in. diameter, of cast iron on the vertical portions, and of ½ in. steel plate on the horizontal portions, were erected by the Gas Department. The horizontal pipes were threaded into place from the interior of the tank, and laid on a concrete bed which had been prepared by the contractor. After fixing, the spaces round the horizontal and outer vertical limbs of the pipes were filled-in solid with 5 : 2 : 1 concrete, well packed into place. Before trimming-off the dumpling to its final shape, concreting was again resumed, in order that the flat portion between the toe of the dumpling and the foundation of the tank wall could be completed. The clay was accordingly excavated, and the concrete put into place all round the toe of the dumpling except for about a length of 30 ft. at the west side; the earth at this point having been left in place to form a wagon road for the circular track round the top of the dumpling.

It will be remembered that it was originally decided to cover the dumpling sides, top, and toe with Lias lime concrete; as this material had very little stress to take, and a fairly big difference in price was expected between it and Portland cement concrete. Actually the difference in price was only two shillings per c. yard in the accepted tender, so that the disadvantage of Lias lime outweighed the advantage expected in the difference of cost. Portland cement concrete of a 6 : 2½ : 1 mixture was therefore substituted in all cases where blue Lias lime concrete was specified. It gave a stronger job, as the two materials were supplied at the same rate per c. yard.

CONCRETING THE DUMPLING.

After placing the concrete footing ring at the toe of the dumpling, it was necessary to work the sides of the dumpling down to the exact slope. About 36 guide slopes were cut from the bottom of the cone to the top. These slopes, about 1 ft. in width, were cut to the exact angle of the dumpling and were trimmed off to a smooth and straight surface, the radius at the base and top being checked by the trammel. The angle of slope was checked throughout the length by template squares and a spirit-level. The portions of the dumpling between the guide slopes were then trimmed off to correspond and to give a circular surface.

In order that the concrete should be of the thickness specified, a series of temporary wood stakes were placed round the dumpling at about 12 ft. centres. To these, gauge boards were attached, the boards being placed 1 ft. 6 in. above the clay, so as to give 18 in. thickness of concrete when filled-in up to the

underside. As concreting of the dumpling advanced in height, the gauge boards were moved up, being reset at each movement to give 18 in. of concrete. This was brought down from the mixers in skips on trolleys, by the 18-in. gauge railway, to a position on the west side of the tank. The steam crane stationed at this point picked up the skip filled with concrete and emptied the contents into a jubilee wagon waiting on the earth bank left in on the interior of the tank (see fig. 1). The wagon load of concrete was then moved round the top of the dumpling, and tipped where required. The concrete was thus shot down the slope of the dumpling and was deposited and trimmed to thickness by workmen, as shown in fig. 2. For several obvious reasons, this was not the ideal way of depositing concrete; but I must admit, however, that it was extremely hard and non-porous after setting, and has proved a very sound job.

When concrete had been placed up to within 2 ft. of the top of the dumpling, concreting was again stopped, in order that the top could be excavated to the finished level; the excavated material being handled by the jubilee wagons and steam crane. The trammel and base block were dismantled, and the top surface of the clay finished-off to the proper slope. Concreting was resumed; the concrete placed on the top of the dumpling being 15 in. in thickness. A centre pin to mark the tank centre, and a circular concrete rest block 6 ft. in diameter by 1 ft. thick was placed in the tank centre to support the centre pillar of the inner lift when at rest in the tank. Forty rest blocks, 7 ft. long by 2 ft. wide by 1 ft. 1½ in. deep, were constructed in the bottom of the tank of 5 :2 :1 concrete; the blocks being placed intermediate with tank guides.

GROUTING.

A few porous places were found in the walls at points where two successive rings of concrete joined; and a seepage of moisture through the wall had resulted at these places. These faults were most probably caused by settlement of the grout of the concrete when in a liquid state, due to the use of barge boards of insufficient depth and tightness when stopping concreting for the night, but might also have been caused through concrete having been mixed very wet. These places were grouted up with 1 to 1 cement under a pressure of 20 lbs. per sq. in., and made tight.

RENDERING THE INTERIOR OF THE TANK.

The whole of the interior of the tank was given two coats of cement rendering, to ensure a watertight job. The rendering actually applied consisted of a primary coat, ½ in. in thickness, consisting of two parts of sand to one part of cement. This was applied to the tank wall by plasterers working on adjustable slings suspended from the holding-down bolts and to the rest of the tank in the usual way. A further finishing coat ¼ in. in thickness, composed of one part of cement to one of sand was then applied over the previous coat; this being worked up to a smooth finish.

FILLING THE TANK WITH WATER.

No water was put into the tank until after the holder was built, which was about a year after the completion of the tank. At this time the flow of water in the stream passing through the site of the works was only about 5000 gallons per hour; and as 2,640,000 gallons were required to fill the tank up to within 21 in. of the coping, it was decided to look for a supply elsewhere, in order to fill the tank quickly. The Leeds and Liverpool Canal is distant about 180 yards from the tank; and as there is a fall of about 20 ft. between the canal and the tank coping, water was syphoned out of the canal through a 4 in. pipe. The length of pipe was 570 ft., and the time of filling 246 hours. The tank was checked for diameter at 20 points along the circumference, the maximum variation being 1½ in.

TEST OF COMPLETED TANK.

A seven days' test after correcting for rainfall proved that the tank was tight. The tank was designed by Mr. J. P. Leather (late Gas Engineer to the Corporation), and the whole of the contract was carried out under his supervision.

I wish to express my thanks to Mr. J. H. Clegg, Engineer and Manager to the Burnley Corporation Gas Department, for permission to present the information contained in this paper, and for valuable advice offered during its preparation.

Discussion.

Mr. SINGLETON (Stockport) said the ballast, sand, and cement were specified; but no mention was made of the water content. He considered this factor was one which called for attention and should be specified.

Mr. YOUNG said that the approximate quantities of water applicable to usual conditions were given in the following table. Generally, he said, it was safe to use the smallest quantity of water which would produce a workable and plastic concrete.

Mixture.		Approximate Mixture, as Usually Expressed.			Water Required. Gallons per C.Ft. of Cement.	
Cement.	Volume of Aggregate after Mixing.	Cement.	Aggregate.			
			Fine.	Coarse.	Minimum.	Maximum.
1	3	1	1½	2½	5	5½
1	4	1	1½	3	5⅞	6
1	4½	1	2	3	5¾	6¼
1	5	1	2	4	6	6½
1	6½	1	2½	5	7¼	7¾
1	7½	1	3	6	8¼	8¾

Mr. WALTON PLATT (Bolton), after expressing his appreciation of the paper, asked how many trial holes were used.

Mr. YOUNG said there were seven holes spaced at a distance of 80 ft.

Mr. PLATT remarked that the data on which the tank was designed had not been given in the paper. The conditions and loading to which a tank might be subjected should be tabulated. Mr. Young's reasons for the rejection of a reinforced concrete tank seemed insufficient. Steel bars at 3-in. centres in a 1 ft. 6 in. concrete wall would offer greater resistance to loading than a plain concrete wall 4 ft. 6 in. thick.

Mr. HAWKYARD (Manchester) thought that the 18 inches of concrete on the dumpling was in excess of requirements.

Mr. FAIRHURST (Altrincham) asked for the position of the inlet and outlet pipes.

Mr. YOUNG replied that one pipe was on the N.E. side of the tank, and one on the S.E. side. They would be about 70 ft. apart.

Mr. SCOTT (Messrs. R. & J. Dempster, Ltd.) thought they had dispensed with the idea of a steel tank very quickly. His firm had orders in hand for over 23 million c.ft. of holder capacity. Of these, one holder had a capacity of 4 millions and another 3½ millions; all the others were to have steel tanks. He recited an instance of one holder that had been installed thirteen years, and when they examined it below the ground they found that little deterioration had taken place. He wondered if they had made sufficient allowance for the fact that they might at some future time require to put down another holder in the immediate neighbourhood of the existing tank.

Mr. LIVESEY (Stretford) asked if the concrete remained clean when it had been tipped down the dumpling.

Mr. YOUNG replied in the affirmative.

Mr. HAYNES (Bolton) moved, and Mr. COOK (Southport) seconded, a vote of thanks to Mr. Young.

Painting of Volatile Liquid Storing Tanks.

Attention is drawn by Mr. Roy C. Sheeler, in the "Gas Age-Record," to the fact that, in addition to preserving the surface, the use of paint on the exterior of a metal tank for the storing of highly volatile liquids serves an extremely important purpose; and the colour must therefore be taken carefully into consideration. Dark-coloured paints absorb heat rays, and cause the interior temperature of the tank to rise rapidly; while gloss finishes absorb less heat than flat paints, for the reason that they reflect more of the light coming in contact with them. Wherever conditions permit, white or light shades should be used, even though it might be necessary to paint these surfaces more frequently than the remainder of the plant. The saving effected by less evaporation of the contents would more than pay for the slight added attention. Dr. H. A. Gardner, Director of the Institute of Paint and Varnish Research, at Washington, has conducted extensive experiments with various coloured paints on small tanks containing benzene. The following figures show the variation in the rise of temperature between the different colours, all of a gloss finish, when subjected to the rays of a carbon arc light for fifteen minutes: Tin plate, 19·8° Fahr. rise in temperature; aluminium paint, 20·5°; white, 22·5°; light cream, 23°; light pink, 23·7°; light blue, 24·3°; light grey, 26·3°; light green, 26·6°; red iron oxide, 29·7°; dark prussian blue, 36·7°; dark chrome green, 39·9°; and black, 54°.

Relative Values of Fertilizers.—The British Sulphate of Ammonia Federation, Ltd., of 28 and 30, Grosvenor Gardens, Westminster, S.W.1, have issued a very ingenious calculator which shows at a glance the relative values of nitrogenous fertilizers, based on the unit value of nitrogen. Thus, if sulphate is £14 per ton, nitrate of soda is worth £10 5s., and nitrate of lime £8 12s. If higher prices than these are asked for, it is to the advantage of the customer to buy sulphate of ammonia.

Hotel Comfort.—More than twelve years' work and nearly £250,000 have been expended by the London Midland and Scottish Railway in renovating the Queen's Hotel at Birmingham, which will be finished within the next few weeks. During the period of alteration systematic trials between electric fires and gas fires have led to the adoption of the latter on the grounds of cost and efficiency of ventilation. In the bedrooms gas fires have been installed with ventilating flues; and slot meters are fixed so that a guest can have a bedroom fire at will.

"The Journal of Good Lighting."—At the conference on illuminating engineering held at Wembley last August, a special resolution was passed approving a scheme to promote public appreciation of the value of better lighting. One of the first results of this resolution has been the issue in an extended form of the "Illuminating Engineer," the official organ of the Illuminating Engineering Society. A section containing more popular matter of interest to all users of light has been added. Another new feature is the inclusion of news from abroad.

INTERNATIONAL COMMISSION ON ILLUMINATION.

(*Continued from p. 220.*)

Over the proceedings of Wednesday afternoon, July 23, Mr. C. C. Paterson, O.B.E., and M. A. Filliol presided.

THE DEVELOPMENT OF GOOD LIGHTING PRACTICE.

The following three papers were first presented in abstract: (1) "Practical Illuminating Engineering," by Mr. A. L. Powell (of the Edison Lamp Works of the General Electric Company, Harrison, N.J., U.S.A.); (2) "The Furtherance of Good Lighting by American Central Stations," by Dr. John W. Lieb (Vice-President of the New York Edison Company); and (3) "The Demonstration Method of Teaching Good Lighting Practice," by Mr. G. S. Merrill (U.S.A.)

Mr. POWELL divided practical illuminating engineering into (*a*) educational work; (*b*) investigations and compilations; (*c*) experimental and developmental; and (*d*) specific recommendations. Included in (*a*) were articles on lighting in daily newspapers; advertisements conveying some real information on lighting practice; material in school text-books, &c.; talks and demonstrations before women's clubs, &c.; broadcasted radio talks; window displays; special demonstrations at strategic points; and handbooks, &c., distributed to the public by the trade. Under (*b*) were treated subjects concerning light and safety; illumination and production; light and sales; light and the drawing power of show windows; effect of daylight intensity on central station load; residential lighting conditions; lighting practice in industrial plants; and lighting practice in shops and other interiors. In dealing with (*c*) the author gave attention to engineering features of sign designs; hospital operating-room lighting; colour and spot lighting for shop windows; overcoming daylight reflections in show windows; depreciation of wall finishes; effect of dirt on the output of lighting equipment; effect of light on plant growth; and development of the reflector and lamp manufacturer's reflector. The specific recommendations set forth under (*d*) were the maintenance by the larger lamp and accessory manufacturers of staffs of competent engineers who are at the disposal of their customers; at the request of the purchaser, a lighting layout is made for his factory, office, church, store, residence, &c. In most instances a very high standard of ethics is in force, and the engineer, even though in the employ of a manufacturer, recommends the system which, in his judgment, is best suited to the user's requirements, regardless of the commercial situation.

Dr. LIEB, in his paper, stated that he knew it was useless to compare American conditions with those of other countries. He believed that there was a great development still possible in the application of electricity to the purposes of illumination. The prosperity of the electrical industry in the United States was largely due to the careful attention which had been given to the incandescent light and to the development of the incandescent lamp in its various stages. Many companies included in their charge for electricity the price for supplying lamps. The consumer's question always was, How could he get the most candle-hours for the least money? The author urged the necessity of never forgetting that the convenience of the consumer was of paramount importance. Contact between company and consumer would always bring satisfaction to both. There was about to be inaugurated a National Research Council investigation into the value of good industrial illumination.

Mr. MERRILL then presented his paper on "The Demonstration Method of Teaching Good Lighting Practice." He described a form of lighting demonstration and lecture which has been used very effectively in the United States to teach the fundamentals of good lighting practice—particularly as they apply to industrial and commercial lighting. The slogan "Seeing is believing" has been used very aptly in connection with them. The first demonstration room was installed at Nela Park in 1919. The lighting units were arranged on a number of different circuits, so that various lighting effects could be illustrated, and some of the units could be raised and lowered to show how the mounting height affected the uniformity of illumination. Foot-candle meters were placed on the tables, and values of illumination throughout the room were measured under the different conditions. Some of the lamps were so arranged that the reflectors could be drawn-up so as to become ineffective. The change in the value of illumination, in the distribution of light, and in the appearance of the room as the reflectors were raised or lowered was very striking to those who had given but little thought to lighting subjects. Another installation was for the demonstration of industrial lighting practice. Also described were portable demonstration rooms which have been used to carry the story of good lighting to over 125 cities in the United States. Much thought was given to perfecting this equipment, to make it easy to put up and dismantle, and to pack it in a small space to facilitate transportation. The author pointed out that the demonstration method had been employed very successfully in London and in Paris.

Discussion.

Mr. LEON GASTER, after congratulating the authors of the papers on their respective productions, said he was glad that the propaganda proposed had not been commenced too early, as he thought that the public would not have been ready to appreciate the value of the recommendations. Further, he believed that such propaganda should not take place from a purely commercial point of view, but to the benefit of the lighting industry, and so secure scientific illumination; and in this sense he strongly supported the liaison which had been suggested.

Mr. MAILLOUX (United States) said they had been honoured by an address from a pioneer of good lighting—Dr. Lieb—who realized that his task was not fulfilled until he had given satisfaction to his consumers. The application of theory and practice was one in which the consumer received his share, as well as did the producer. The Commission then sitting should fulfil the function Dr. Lieb had always advocated and practised—namely, that of arbitrator and referee between the producer and the consumer.

M. BOSSU supported the two previous speakers, and said that France would follow the example of the United States in striving to provide the public with the very best form of lighting possible.

Mr. ROBERT WATSON (Doncaster) remarked that, while the Commission had been quite properly engaged on matters concerning pure science and the effect of illumination on the human system, all such investigations were useless unless they proved of service to the public who employed the illumination. He regretted that the United States Committee had not been able to send a gas engineering representative, as he presumed that the three papers had reference to electric lighting. In England, the two industries of gas and electricity were closely allied; and he mentioned that extensive propaganda work had been carried out throughout the British gas industry. It was a fact that the clients of private companies running maintenance systems, by which inspectors visited houses and watched the working of gas appliances installed, used 20 p.ct. more gas than did the clients of other companies.

Mr. WALTER DUNN (London) called attention to the matter of legal enactments in various countries on the question of adequate lighting. In Great Britain, there were Acts of Parliament relating to industrial operations; and he suggested that the representatives of other countries should state what legal enactments were in force compelling manufacturers to provide good lighting in their shops. It might be difficult to apply such enactments to private lighting, but he hoped that in time a sufficiency of satisfactory lighting would be enforced in private dwelling houses. He concluded by asking Dr. Lieb if he would, in his reply, give some indication of what had been done in the gas industry.

Dr. LIEB, in his reply, said he had much pleasure in responding to the request of the last speaker, because in the first place the New York Edison Company, of which he was Vice-President, was owned by a gas company; and, secondly, he had had the honour of representing the American Gas Association on the occasion of the jubilee celebrations of the Institution of Gas Engineers. He remarked that the gas industry in America was fully alive to the problems with which he had dealt in his paper. As to legislation, he did not think that this would be a profitable sphere for the International Commission on Illumination to occupy itself with.

Dr. HYDE (United States) proposed, and it was agreed, that the subject should be discussed at the next triennial meeting of the Commission.

STREET LIGHTING.

M. Filliol then took the chair, and the following papers were given in abstract and discussed: (1) "Street Lighting," by Mr. Haydn T. Harrison, M.Inst.E.E., which in his unavoidable absence was presented by Mr. Walsh; (2) "L'Eclairage des Voies Publiques à Paris par le Gaz," by M. Laurain, of Paris (presented by Mr. Blondin); (3) "Dispositifs Nouveaux de Signalisation Lumineuse Appliqués à la Réglementation de la Circulation dans les Villes, à la Réclame Lumineuse et à l'Eclairage des Immeubles," by M. F. Cellerier, Vice-Président du Comité Français de l'Eclairage et du Chauffage (which was presented by M. Bossu); and (4) "L'Eclairage des Voies Publiques à Paris par l'Electricité," by M. J. Mariage, Ingénieur en Chef de l'Eclairage Publique de la Compagnie Parisienne de Distribution d'Electricité.

Mr. HARRISON referred in his introduction to the common saying that "London is the best and worst lighted city in the world." This had, in fact, been proved by a series of tests taken in 1911, which showed that certain streets were illuminated to a minimum degree of 0·25 foot-candle on a horizontal plane 1 metre above the ground level, whereas others were considerably lower than 0·006 foot-candle, which at that time was the lowest illumination that could be conveniently measured by a photometer on the site. Many attempts had been made to draft regulations in Great Britain, America, and elsewhere. On examining these, it would be noted that considerable diversity of opinion existed as to the best means of attaining the objects aimed at. In the case of Great Britain a Committee, representing various technical organizations, in 1913 reported that they were not unanimous as to the adoption of the minimum horizontal illumination as a suitable basis for comparison or specification. In America the view was taken that it was better to specify certain light units and the spacing and height at which they were to be used.

The author enumerated the objects to be attained, in the following order of importance: (1) Visibility of objects on the road; (2) visibility of objects on the footpath; (3) low brilliancy of light sources in area of vision; (4) even illumination; (5) minimum obstruction to traffic or to pedestrians; and (6) reliability and constancy of power of lighting sources. He submitted that when considering the fast motor-car traffic of the present day, road or horizontal illumination ceased to be the

important factor, and that direct illumination of objects projecting from the road required more careful consideration. The London "Safety First" Council recommended that there should be sufficient light to enable a person or object of substantial size to be distinguished at a distance of 100 ft. ahead of a vehicle, and mentioned 500 to 1000 c.p. if dark objects were to be distinguished. In such circumstances, the illumination (direct) would be 0·05 to 0·1 foot-candle. The road or horizontal illumination being 0·002 to 0·004 foot-candle from one light source, it would be double that if adjacent light sources were considered.

The National Physical Laboratory (England) suggested that an illumination of 0·1 foot-candle was necessary for visibility at 200 ft. It would appear that the various bodies who have dealt with the question of the illumination necessary to ensure safety under the present traffic conditions have advised: (*a*) That the road illumination necessary as provided by the street lighting should not be less than 0·001 foot-candle; (*b*) that 500 to 1000 c.p. at a distance of 100 ft. is necessary (*i.e.*, a direct illumination having a minimum of 0·05 foot-candle, or horizontal illumination of 0·004 foot-candle); (*c*) that visibility at 200 ft. is necessary, or (say) a direct illumination of 0·1 foot-candle. The inconsistency of these views makes it difficult to come to any definite decision.

Mr. Harrison submitted that the only means at present found satisfactory for preventing accidents—namely, light concentrated on to the road from sources attached to the vehicles—should be borne in mind when considering fixed lighting sources controlled by road authorities; and he suggested for discussion that such a scheme would prove a practical solution of the problem now remaining unsolved. There were certain advantages in this proposal—namely, that the road authorities, having lights directly under their control, would, if they provided the necessary illumination, be in a position to forbid, and make penal, the use of vehicle lights the power and arrangement of which were often a source of danger to the public. The author concluded with the hope that his paper might assist in achieving the desired adoption of some definite standard by which the safety of the public would be in the hands of those authorities who could be trusted to deal with it, and not left to the care of the class of vehicle owner and driver who apparently did not think it worthy of consideration.

The three other papers were then taken.

Discussion.

The CHAIRMAN, in opening the discussion, said he thought that Mr. Harrison's paper perhaps merited the closest attention of the Commission, as it raised the very important questions of the standard of measurement and the minimum luminous intensity.

There was an animated discussion on various points. In the course of it,

M. MAILLOUX referred to what took place in Paris at the congress of 1900, when it was proposed to ask the different countries represented to establish laws. The proposal was promptly turned-down. He was of opinion that the most the present Commission could do was to express their opinion on the important matters raised in connection with street lighting, and perhaps communicate hints to the various countries; but even those should be couched in the most tactful and diplomatic language.

Mr. BOSSU dissented from this view.

M. CAROZZI, on being invited to speak, said he thought it was necessary to establish some form of legal minimum of illumination, with a view to the adoption of a draft convention or recommendation. It was clear that legislation on the subject had been so far useless in many cases, because no minimum had been adopted, or because provisions had been proposed in terms too vague. If the Commission could draft a standard from a technical point of view, it would be of great assistance to the Labour Bureau of the League of Nations, when considering the question of industrial lighting, which came under their purview.

Dr. SHARP was of opinion that, if the Commission could recommend legislation in regard to factory and school lighting, it was competent to do so with respect to street illumination, and to recommend the respective Governments to impose on the municipalities certain requirements. There was a difference between the province of the State in protecting its citizens engaged in factory work, and the duty of the municipalities in regard to regulations for the illumination of streets. He proposed that the subject of street illumination should be placed on the agenda of the next plenary meeting of the Commission; and this was agreed to.

(To be continued.)

Southern Association of Gas Engineers and Managers.—A preliminary intimation has been received from the Hon. Secretary (Mr. H. C. Smith, of Tottenham) that the next general meeting of the Association will be held at the Hotel Cecil, Strand, W.C., on Tuesday, March 24, at 2.15.

Heat Engine Trials.—Members and students of the Institution of Gas Engineers are invited to attend a meeting at the Institution of Civil Engineers, Great George Street, Westminster, at 6 p.m. on Wednesday, March 25, when the Heat Engine Trials Committee will present for discussion the standard form or code for tabulating the results of a steam generating plant trial. Mr. W. H. Patchell, Chairman of the Panel responsible for drafting the code, will introduce the subject.

PROGRESS OF SULPHATE IN FRANCE.

From the "Journal des Usines à Gaz" for Jan. 5, we take the following statistics demonstrating the largely increasing use of sulphate of ammonia as a fertilizer in France.

During the second half of the 19th century, when the use of chemical manures was developing, the French agriculturist demanded Chile nitrate for almost the whole of his needs. Little ammonia salt was produced in France; and consumption of this little-known fertilizer was confined to the districts round Paris and the northern ports. In 1900, France used the following amounts of nitrogenous fertilizers:

Sulphate	49,000 t.	N_2 content	9,800 t.
Nitrate	260,000 t.	,, ,,	39,000 t.

[t. = metric tons.]

In 1903, Norway commenced to produce synthetic calcium nitrate; and a little later calcium cyanamide appeared in France. In 1913, the fertilizer position was as follows:

AMMONIA.

Sulphate	97,000 t.	N_2 content	19,400 t.
Cyanamide	12,500 t.	,, ,,	2,500 t.

NITRATES.

Sodium	314,000 t.	N_2 content	7,100 t.
Calcium	6,000 t.	,, ,,	780 t.

Thus the figures for 1913 already show a marked increase over 1903 in the utilization of ammoniacal manures. This progress was accentuated in the years immediately following the war; and in 1923 ammonia drew level with the nitrates as far as the nitrogen equivalent was concerned.

AMMONIA.

Sulphate	154,000 t.	N_2 content	30,800 t.
Chloride	2,000 t.	,, ,,	460 t.
Cyanamide	50,000 t.	,, ,,	9,000 t.

NITRATES.

Sodium	260,000 t.	N_2 content	39,000 t.
Calcium	11,000 t.	,, ,,	1,430 t.

The relative extent of use during these three example years is shown by the following percentages:

	AMMONIA.	NITRATES.
1900	13·50	86·50
1913	31·10	68·90
1923	49·90	50 10

It is very likely that during 1924 more ammonia was employed than nitrates; and everything points to the probability of such a lead being increased in the future. French industry is looking to it that in the near future the farmers shall have at their disposal a considerably enhanced tonnage of ammonia fertilizers (sulphate, chloride, cyanamide, and urea); and it is natural that the French peasant should give the home-produced article the preference over that imported.

Our contemporary concludes by remarking that the favour shown by agriculturists not only in France, but throughout the world, to ammoniacal manures is entirely justified by results. All tests and all practical results demonstrate that they are fully equal to the nitrates. If they work rather more slowly, they have *per contra* the advantages of functioning more sweetly and continuously, and of being applicable during the autumn, since the salt is entirely absorbed by the soil itself.

Complete Gasification Lecture at Leeds.—The Leeds University Cavendish Society are to have a lecture by Dr. M. W. Travers, F.R.S., on "The Complete Gasification of Coal for Town's Gas Supply," next Tuesday (Feb. 17), at 5 o'clock, in the Chemistry Lecture Theatre. All interested are invited to be present.

Ecole Nationale Supérieure du Pétrole et des Combustibles Liquides.—Such is the title of a national college which has been founded at Strasburg. The objects are: To train specialist engineers for the liquid fuel industries; and to institute and develop theoretical and applied research into liquid fuels. The administration of the school is to be in the hands of a council of eighteen and a director responsible to them.

Remedy Against Carbon Monoxide Poisoning.—According to "Feuer und Wasser," says the "American Gas Journal," a remedy has been prepared from the plant known as Lobelia Inflata, which grows wild in North America, and which can be used with good results to combat carbon monoxide poisoning. This plant contains several alkaloids, and methods have now been perfected for removing these from the plant, and deriving from them a preparation which can be taken internally without the bad effects that have been prevalent heretofore when similar substances were used for this purpose. The alkaloids in the mixture have the power of stimulating the nerve centres which control the respiratory organs. When a person is overcome with carbon monoxide, the breathing is very weak; and an intravenous injection of this preparation seems to have the power of stimulating the breathing, even after oxygen has been resorted to without success. There does not seem to be any bad after-effect from the administration of this preparation, which is called "Lobelin," and is manufactured and sold in Germany.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Gas and Electricity Supply.

SIR,—Apropos this interesting subject, which is doubtless receiving the serious consideration of gas undertakings—and rightly so, in view of the great possibilities open to them in the electricity supply industry, by amalgamation of the two services—much harm can be done by the somewhat sweeping statements uttered by ardent enthusiasts of coal conservation, because such statements are bound to meet with criticism sooner or later; and failing their verification, one may be led to infer some ulterior motive on the part of the advocates.

For instance, in the November issue of one of your contemporaries a paragraph appears—"the recent report (1924) of the Electricity Commissioners records that the highest thermal efficiency of large and small coal, oil, and gas operated electric generating stations in the country was obtained by a very small internal combustion engine station. . . ." The advocate, proceeding with his article, elaborates on gas and coke *versus* steam, which may lead some to believe that the "small internal combustion engine station" cited was a gas engine station, whereas, searching through my copy of the Commissioners' (1924) report I find no such station that gives a higher thermal efficiency than the 17 p.ct. he quotes for steam stations.

There are five oil engine stations with a higher figure quoted in the Commissioners' report, one of which is situate in East Anglia (9 p.ct. more than the 20 p.ct. steam station at Manchester).

Apart from this published statement there are also claims being made to the effect that waste heat from retorts is sufficient to supply all necessary electrical needs in any one town. While not desirous of discouraging gas undertakings of suitable capacity from what may prove to be a good proposition, I would strongly advise them to exercise due caution when venturing on a scheme of amalgamation.

J. C. ELVY,
Consulting Electrical Engineer.

3-7, *Southampton Street, W.C.* 2,
Feb. 4, 1925.

[Our correspondent may rest assured that gas undertakings are exercising due caution in extending their enterprise to electricity generation. They are not without experience as to what they can do in the matter; and practical experience has accumulated, and is daily doing so, regarding the quantity of steam that can be generated on their works from the waste heat of retort-settings and water gas plants.—ED. "G.J."]

MISCELLANEOUS NEWS.

LIGHTNING STRIKE AT NEWPORT (MON.).

One Day's Cessation of Work.

An unauthorized strike of the workers at the Newport Gas-Works took place on Feb. 3. It appears that on Jan. 31 one of the Company's employees refused to perform certain duties which previously had always been carried out by men of his particular category. As he persisted in his refusal, the management had no alternative but to dispense with his services. The man appealed to Mr. J. H. Canning, Engineer and Manager, who considered that it was a matter which should be taken up through his Trade Union, but had no option, on the man's refusal, but to confirm the previous decision. On Feb. 2, Mr. Canning had an interview with two Union officials, who appeared to be perfectly satisfied with his explanation, and gave no intimation that further action was contemplated. However, a meeting attended by less than half the Company's workmen was held during the evening of the same day; and it was resolved that the employees of the Company should come out on strike on the following day, the 3rd inst., at 6 a.m. On hearing of this decision, Mr. Canning took immediate steps to safeguard the supply of gas to the public, and laid the case before Mr. Ogilvie, the Manager of the Gas Employers' Federation, who communicated with Mr. W. Thorne, M.P., with the result that work was resumed on the following terms:

1. All the men, including the dismissed man, to resume work at 10 p.m. on Feb. 3 (the day of the strike).
2. The man who was dismissed to withdraw his refusal to carry out the work, in consideration of which the Gas Company should withdraw the dismissal.

Mr. Thorne reported the matter at a meeting of the Joint Industrial Council on Feb. 4, and asked that body to arbitrate on the conditions, &c., of work in this case; both sides pledging themselves to accept the arbitrator's award.

It may be mentioned that, thanks to the loyalty of the Company's staff, the gas supply was fully maintained.

City of Durham Gas Company.—The accounts presented to the 52nd annual meeting of the City of Durham Gas Company showed an available balance of £3507 (after deducting the interim dividend); and the Directors recommended that dividends for the half-year ended Dec. 31 of 5 p.ct. on the original capital and 3½ p.ct. on the additional capital (less income-tax), be paid. The Chairman (Mr. George Chapman) congratulated the shareholders on a satisfactory balance-sheet, as trade and business generally had been in a very bad state during the whole of the year. Notwithstanding this, the quantity of gas sold by meter showed a substantial increase. There was also a small increase in the number of consumers.

SOUTH METROPOLITAN GAS COMPANY.

Old Kent Road Foremen's Association.

The second annual dinner of the Association was held at Anderton's Hotel, Fleet Street, on Saturday, Jan. 31. Mr. F. A. FROST (Works Superintendent) occupied the chair, and was supported by Mr. H. T. Manley (Employees' Director), Mr. T. S. F. Gibson (Chief Civil Engineer), Mr. R. C. Macdonald (Chief Mechanical Superintendent), Mr. W. V. Palmer (Meter Shops Superintendent), and other officers. An orchestra under the direction of Mr. W. Donnelly rendered an excellent programme of music while the dinner was in progress, and the musical programme which followed was given by members of the Company's staff and friends.

The toast of "The South Metropolitan Gas Company" was in the hands of the CHAIRMAN, who, in submitting it, said that the subject called for no elaborate remarks of his to induce them to receive it with acclamation. He pointed out that the prosperity of the Company meant prosperity to themselves in a variety of ways. They all felt very proud to be associated with a concern which was looked up to by gas undertakings throughout the Kingdom. Whatever anxieties the Directors of the Company might have in other matters—and they doubtless had many, in these days—they certainly entertained none so far as their relations with their employees were concerned. On the contrary, they looked to them to assist in overcoming some of these difficulties. Providing they continued to extend to their Directors that loyal and efficient service which had been a feature of the co-partnership system for the past 35 years, no doubt need assail their minds as to the future prosperity of the Company. He welcomed with them that evening Mr. H. T. Manley.

Mr. MANLEY, in responding, thanked the assembly for the cordial manner in which they had received the toast. He would take an early opportunity of conveying to the Directors the goodwill they had expressed towards them. He referred to the different interests which had to be considered in a Company such as theirs, and assured them that, whatever matters might arise for discussion, due regard was always given to the interests of shareholders, employees, and consumers alike. It afforded the management great satisfaction to know that they had the undivided support of their employees, eliminating, as it did, any labour difficulties.

The toast of "The Visitors" was proposed by Mr. H. PUTT, who referred to the comradeship which pervaded the Association. This, he said, was still further enhanced by the active support and sympathy they received from their chiefs. He thanked those present for the assistance they had given. This toast was responded to by Mr. H. PERKINS, the Secretary of the Staff Club at the East Greenwich Works.

The toast of the Foremen's Association was then proposed by Mr. PALMER, who congratulated the members on the good work which they had accomplished. Since its formation a much better spirit had prevailed throughout the different departments. This had made them realize that by assisting each other when occasion demanded they were benefiting the Company as a whole. He emphasized the importance of the visits they had made to other works. This helped them to increase their knowledge and add to their efficiency.

In responding to this toast, the CHAIRMAN referred to the different visits that had been made, the result of which had considerably broadened the members' knowledge and outlook—one of the principal aims and objects for which the Association had been formed. He outlined a further number of visits which would be made in the near future, and felt sure that the interest the members had shown towards them would be sustained.

The toast of "The Chairman" was proposed by Mr. A. ASHMAN, and was enthusiastically received.

Mr. FROST, replying, said he was appreciative of the honour of being their President, and assured them that he was at all times prepared to help them. He thanked them for the cordial manner in which they had expressed their appreciation of his services.

Gas Lighting at Brixham.—The sum of £700 offered by the Brixham Urban District Council to the Brixham Gas Company for lighting the public lamps on a nine months' contract has been rejected in favour of offering £750 for a twelve months' contract for lighting till 11 p.m.

Pudsey Gas Company.—In their report for the year ended Dec. 31, 1924, the Directors state that the sales of gas show an increase of 4·20 p.ct., compared with the quantity sold in 1923. An interim dividend at the rate of 10 p.ct. per annum was paid in August; and the Directors recommend a similar dividend for the past half-year.

Cambridge University and Town Gas Light Company.—The annual meeting of the Company was held yesterday. The Directors recommended the declaration of a dividend at the usual rates. To meet the increased demand for gas, a new retort house has been erected, and contracts have been placed for a 3 million c.ft. holder. To provide the necessary capital for these extensions, the Directors have decided to offer in March next £15,000 "B" stock, and also to raise further loan capital.

Scarborough Gas Company.—The report of the Directors for the year ended Dec. 31, 1924, is to be presented at the general meeting of the Company on Saturday next. After providing for interest charges and the dividends on the preference stocks, the Directors recommend the payment of the usual dividends on the ordinary stocks at the rate of 5 p.ct. per annum. To make up the sum required for dividends, an amount of £7012 is taken from the reserve account, which now stands at £16,077, as compared with £16,487 two years ago. The necessity for this withdrawal is chiefly due to exceptional expenditure on renewal of mains and services, public lighting improvements, to reduced income owing to the decrease in the price of gas (which has represented a saving of £6000 to the consumers during the last nine months), and to the much lower prices obtained for tar. The sale of gas for the year shows an increase of 24 million c.ft. (5 p.ct.) over the previous twelve months.

THE GAS LIGHT AND COKE COMPANY.

Ordinary General Meeting.

The Two Hundred and Eighteenth Ordinary General Meeting of the Proprietors was held last Friday, at the Chief Office, Horseferry Road, Westminster, S.W., Mr. D. MILNE WATSON (the Governor) presiding.

The SECRETARY (Mr. W. L. Galbraith) read the notice convening the meeting; and the report and accounts were taken as read.

The corporate seal of the Company was thereafter affixed to the register of holders of capital stocks.

The GOVERNOR: Ladies and gentlemen,—I am pleased to say that business during the past year has been very satisfactory, and though we close with a slightly decreased balance to be carried forward to next year's account—namely, £223,000, instead of £227,000—we have had an increase in output of 6¼ p.ct., which represents in a Company of this magnitude a very large additional quantity of gas sold. Dealing first with the accounts, you will notice that we have spent a large sum of money on capital account—viz., £616,000. Of this amount, £122,000 was for land, £100,000 for buildings and machinery in extension of works, £145,000 for additional mains and service pipes, £72,000 for new meters, and £177,000 for new stoves. The land was acquired for two purposes—extension of works and new premises for district offices and showrooms. At our Nine Elms manufacturing station we were somewhat cramped for space, and were fortunate in being able to acquire premises formerly in the occupation of Messrs. Crosse and Blackwell. These premises are immediately adjacent to our works, and will form a valuable extension. We have, as I said, also bought land for the erection of district offices and showrooms in various parts of our district. This step became necessary owing to the enormous increase in our business which has taken place in the last few years. For the same reason we were compelled to spend large sums of money on new mains and services; districts being opened up which need a supply of gas, and new meters being required by an ever-increasing number of consumers. Additional stoves have had to be provided to satisfy the demand brought about by the extension of heating and cooking in all our districts. Against this expenditure of £616,000 we have written off £70,000. There has, therefore, been a net increase in capital expenditure of £546,000, which has turned a credit capital balance of £198,000 at the end of 1923 into a debit capital balance of £348,000 at the end of the year 1924. Inasmuch, however, as this expenditure has been entirely due to the extension of our business, there is no need for anxiety on this score. In fact, it may fairly be regarded as an indication of the enormous strides that have been made by the Company, particularly during the past few years. Turning now to the revenue account, coal cost us more in 1924 than in 1923. There was a small increase in the price, but the greater part of the additional expenditure of £250,000 was due to the larger quantity which was consumed owing to the increase in business. Oil also cost us more for the same reason.

KEEPING ABREAST OF IMPROVEMENTS.

You will observe that there has been a considerable advance in the expenditure on repairing and renewing stoves. This is due to the policy which the Company are following of steadily eliminating the old-fashioned types of cookers and fires, and bringing them generally up to date. In other directions, also, the Directors are taking steps to keep the Company abreast of all modern improvements; and in this connection I would refer especially to the success that has attended the installation of waste-heat boilers at all our works. Under the heading of co-partnership there is an increase of expenditure owing to the larger number of co-partners and to a somewhat higher bonus for the year. The cost under this heading for the year was £72,000. On the other side of the account, the income for gas—viz., £6,279,608—is practically the same as the year before, though the price of gas over the year 1924 was lower than in 1923. This is due, of course, to increased sales. The rentals from meters, stoves, and fittings show an increase, taken together, of some £80,000, which is extremely satisfactory, being due, as it is, to increased business. The Company realized £230,000 more from the sale of coke and breeze than in the previous year, but unfortunately this was counterbalanced to a large extent by a falling-off in the revenue from tar and ammoniacal liquor; the result being that there was an increase of only £42,000 on residual products taken as a whole. I regret to say that the future outlook in the residuals market is far from good; and we shall have to face a large decrease in revenue from this source. If you turn to the general balance-sheet, you will see at a glance how the position of the Company has been affected by the large sum of money we have had to find for capital expenditure. Whereas last year we had in cash and invested some £1,244,000, this year we have in cash and on deposit only £567,000. It should be pointed out, however, that there is a further £300,000 locked up in stocks of coal, coke, &c. The net result of the year's working enables us to pay a dividend of £5 6s. 8d. p.ct. (which is the dividend we are entitled to under the sliding-scale), and to carry forward, as I have already said, £223,000 to the credit of next year. As I mentioned at the beginning of my speech, the Company has had an increase in business of 6¼ p.ct. For those who do not realize the magnitude of this Company's operations, 6¼ p.ct. perhaps means but little. It represents, however, a quantity of over 2000 million c.ft., or 10 million therms, which is equal to the total requirements of a town as large as Portsmouth or Brighton for a year.

STRIKING PROGRESS IN THE GAS INDUSTRY.

You will understand how extraordinarily alive the gas business is in London when I tell you we had a record year for total sales of gas, and also a record day's output on Dec. 10, when we sold 166 million c.ft. of gas. Considering the progress of this Company, and other gas undertakings, it is strange to find that there are many people who still think that the days of gas are numbered. It is difficult to account for this belief. No doubt it is fostered by those who wish to see the gas industry go under, but there must be other reasons. It may possibly be due to the fact that gas as a means of lighting is not so much in evidence to-day as it was in the past, the result being that the casual observer going about London may get the impression that gas is disappearing altogether. How many people realize that the wonderful lighting in Whitehall and many parts of the West End is done by gas, and that this Company alone light no less than 1000 miles of streets? When I tell you that the output in a district like Bond Street or Piccadilly, in which it is difficult in the course of a walk to discover that gas is being used at all, has increased during the last twenty years by more than 20 p.ct., and that in the Harley Street district, where, again, you will hardly notice a gas light, more gas for domestic purposes is used per square mile than in any other part of London, you will see that our position is really a very strong one. I was very much interested recently in this connection on looking at an advertisement issued by a well-known London hotel some thirty-five years ago, in which they indicated in bold letters that "no gas" was used on their premises—presumably as an attraction to prospective visitors. To-day that same hotel is using gas to the extent of a million c.ft. per month.

20 P.CT. INCREASE IN THREE YEARS.

I was recently speaking on the subject of gas to a well-known public man, and he said: "You will not deny, Mr. Watson, that gas is on the wane." Now this remark could not have been made were it generally known that since the year 1921 there has been an increase of no less than 20 p.ct. in the sale of gas, an increase equal in quantity to 6000 million c.ft. over a year. By far the greatest proportion of this increase has been due to the remarkable development in the sphere of cooking and heating, as well as for industrial purposes—furnace work, &c. Since the year just mentioned, there has been an increase of over 200,000 in the number of cooking stoves and fires placed out on hire and sold. At last year's meeting I drew attention to the fact that the Gas Light and Coke Company alone produced approximately in a year as much energy for light, heat, and power as is produced in the form of electricity by the whole of the electrical undertakings in Great Britain. There was a great deal of astonishment expressed at that statement, but it has never been controverted.

A COMPARISON OF COSTS.

There is another aspect of the matter to which I should like to draw attention—viz., the revenue from the sale of gas, or, to put it in another way, the cost to the consumer. For the vast quantity of heat units that were supplied by this Company during the year for all purposes—viz., 183,000,000 therms, the consumers paid just over £6,000,000. Were the electricians called upon to replace the use of this gas by electricity, it would mean that they would have to furnish a supply of over 5000 million Board of Trade units; and if these units were to be sold at a total cost to the consumer of £6,000,000, it would be necessary for the charge per unit to be in the neighbourhood of a farthing. On referring to one of the recently published electrical trade journals, the average charge for electricity for all purposes was found to be as nearly as possible 2d. per unit. Even allowing for a claim for a somewhat higher efficiency of utilization to which the electricians might consider they were in certain cases entitled, which would reduce to some small extent the difference between the ½d. and the 2d. per unit quoted, there is no justification, if any regard at all is to be had to the economics of the question, for the agitation in some quarters for the introduction of electricity for every domestic purpose.

THE ECONOMIC SOURCE OF HEAT.

The figures I have given appear to me to make it clear that in a country where, for all practical purposes, our supplies of electricity, as of gas, are dependent entirely upon coal, there can be no question of electricity economically displacing gas as a source of heat in our homes and factories. Apart from this aspect of the matter, there is the question of conserving the country's resources in the way of coal, where the advantage, as has so often been pointed out, lies heavily in the direction of gas manufacture. I do not for one moment want it thought that electricity could or should be entirely superseded by gas, because there are places in which, and purposes for which, electricity is eminently suitable; but I have mentioned this matter in order to show that it is wrong to think that the country would be the gainer by displacing gas by electricity.

FAIR PLAY AND NO FAVOUR.

The public evidently appreciate gas, or they would not use it in largely increasing quantities; and it is only right that politicians and others who are in positions of authority should know the truth. What we want is fair play and no favour. In particular, if the State is going to give financial assistance to electricity, in common fairness the same privilege ought to be extended to gas. ["Hear, hear."] The reason I deal with this question at such length is that I am most anxious to let the public know the real facts of the case, as there seems to be a tendency, especially among politicians, to boost electricity at all costs. As I have said frequently from this chair, there is a large field for both gas and electricity in which to work for efficiency and economy, the saving of labour, and the cleansing of the atmosphere of our towns.

WEMBLEY.

The Company joined with other undertakings in carrying out a joint gas exhibit at the British Empire Exhibition. The Exhibit was a great success, and was visited by hundreds of thousands of people. It is interesting to know that, throughout the length and breadth of Great Britain, it has led to increased business. We have therefore

decided to exhibit again this year at Wembley, and we hope to obtain equally good results.

THE ACTION REGARDING CAUSTIC SODA MANUFACTURE.

You will remember that last year I told you that a shareholder had unsuccessfully brought an action against us in the Law Courts to prevent the Company from manufacturing caustic soda. It was admitted that it was not so much the immediate question of the caustic soda as the principle of preventing the Company from manufacturing substances required in treating their residuals. We found that caustic soda could be made by us more cheaply than it could be bought; and therefore we put up a plant for its manufacture. The shareholder concerned, who is Secretary to the Castner Kellner Company, and represents a group of manufacturers, carried the matter to the Court of Appeal; and we again got a decision in our favour. This is satisfactory from the Company's point of view; but we hear that the appeal is to be taken to the House of Lords, so there is nothing more to be said until that tribunal gives its decision.

CO-PARTNERSHIP.

I have already pointed out the increase in the amount charged to co-partnership—namely, £72,000, as against £64,000. Co-partnership is working extremely well in the Company. There are now 12,543 co-partners, holding altogether nearly £500,000 ordinary stock of the Company, together with a large sum on deposit. During the past year our relationship with our men has been of a very pleasant character. In these days, when so much is being said about the necessity of improving the understanding between Capital and Labour, I may possibly be pardoned, as head of one of the largest concerns working on co-partnership lines in this country, if I say a few words on the subject. There would appear to be three common objections to co-partnership from the point of view of its general adoption throughout the country. First, that losses are not shared as well as profits; secondly, that co-partnership is not suited to businesses which are here to-day and gone to-morrow; and, thirdly, that small businesses would find it impossible in many cases, and difficult in others, to arrange for the sharing and transfer of capital to the employees, as can be done by a large undertaking. With regard to the first objection, it seems to me to be unreasonable—in fact, impossible—to expect a wage earner to assist in sharing a loss, however small. With regard to the second objection, it may be perfectly true that it does not suit ephemeral businesses, and it may be difficult to apply it to businesses which are just starting; but there are thousands of companies which have been established for many years which might very well institute a co-partnership scheme at once. There is a real difficulty in the third case. While it is extremely desirable that men should hold stock in the company for which they are working, there is no reason why the bonuses should not be invested for them in some Government or local authority security, the stock being held under regulations such as are in force in the case of this Company as regards co-partnership stock. For the benefit of those who are interested in this subject, I may say once more that our method for computing the bonus each year is that a sum calculated at the same rate as the dividend paid by the Company on the ordinary stock is given to each co-partner on a certain portion of his earnings. In this way there is a basis which could be applied to any business. The small business with large labour costs could adjust the proportion of wages to be taken as hypothetical capital, so as to give a fair bonus. It is difficult to explain in a few words, but to anyone who is interested in the subject we shall be pleased to supply copies of the rules of our co-partnership scheme, which has been in operation now for a number of years.

RELATIONS WITH LABOUR.

The gas industry has, up to now, been very fortunate in its relationship with the men working for it, and I hope it will continue to be so. I believe not a little of the success is due to the fact that so many of the men in the industry are co-partners. We have a Joint Industrial Council for the industry, which has worked very satisfactorily, and of which I have had the honour to be Chairman for the past six years. I regret to say, however, that there is at present a deadlock in the industry. The men's leaders have put in a claim for an advance of 12s. a week in wages, time-and-a-quarter for night work, and 14 days' minimum holiday per annum. The gas industry does not see its way to agree to any of these claims, particularly in view of the serious slump in the residuals market, which may affect the price of gas throughout the country. The employers, on their side, claimed that the conditions of the sliding-scale under which wages had been regulated should be modified. We did not propose, however—and I want this to be remembered—any reduction in wages at the present time. This being the position, we offered to go to arbitration on the whole dispute. Our offer, however, was turned down by the Trade Union leaders, who would only agree to an arbitration on their own demands, to the exclusion of the counter-claims of the employers; and so the deadlock has arisen. We are working under an agreement which continues until March 31; and I hope that before then the men's leaders may see the fairness of submitting both claims and counter-claims to arbitration. I notice that Mr. Hayday, the Trade Union leader, inferred in a statement made yesterday that the industry should pay higher wages because the average increase in the cost of gas to the consumer was only 50 p.ct. above the pre-war price, whereas the cost of living was 80 p.ct. up. I cannot, however, agree with Mr. Hayday's claim. The gas industry is a three-fold partnership—the workers, the consumers, and the shareholders. The facts are: The workers are already receiving from about 80 p.ct. up to 120 p.ct. above pre-war wages, and therefore in their case the increased cost of living has been fully met, whereas the consumers are paying 50 p.ct. and more for their gas, and the shareholders are in a still worse position because they are only receiving about 10 p.ct. more in dividends than before the war, and this leaves out of consideration the heavier income-tax which has to be paid. These are the true facts of the case. If wages went up, it would mean an increase in the cost of gas, and a lower dividend, because we work under a sliding-scale. In addition to this, I should like to point out that any increase in the price of gas would fall heavily upon the working classes, who depend so much upon gas both for light and heat. In addition to co-partnership, as I have told you on previous occasions, we have contributory pension schemes in full operation which are of the greatest benefit to all co-partners. We also take care of the physical wants of our employees by providing Sports Grounds, which give them the opportunity for healthy exercise, and which I have every reason to believe are greatly appreciated.

"THE RANGERS."

Furthermore, I am glad to say that we have been able this year to revive the old connection which existed between the Company and the 12th Battalion of the London Regiment, usually known as "The Rangers." It is gratifying that there has been such a hearty response to the appeal made in this direction; and I am informed that the Gas Light and Coke Company are unique in this respect among the great businesses in the country.

THE STAFF.

To meet the enormous demand for the supply of gas, the energies of the staff, both officers and men, both indoor and outdoor, have been taxed to the utmost, and I am glad to say that they, as a whole, have risen to the occasion and worked splendidly. I do not think there is any Company better served than this one in this respect.

NEW SHOWROOM.

You will be interested to see that we have been re-decorating our premises here; and I trust that you will find a few minutes after the meeting to look at our new showroom. One of the fallacies we have to fight is that gas is old-fashioned. We have endeavoured, therefore, to show that it is not so, and that it can be used with success for both lighting and heating in beautiful surroundings.

I have pleasure in moving:

> That this meeting do agree with and confirm the Report of the Directors and the Auditors' report and statement of the accounts of the Company as transmitted to the proprietors on the 26th ult.

Mr. HENRY WOODALL: I have very much pleasure in seconding the motion.

MR. JONES SUPPORTS.

Mr. H. E. JONES: I should like, as one having some knowledge of the subject with which you have been so eloquently and so wisely dealing, to add my support to the adoption of the report and accounts. The history of the undertaking for the past three years—and for some years before that—has been one of extraordinary financial improvement. In fact, I went so far as to congratulate the Governor the other day, and to tell him that in a couple of years he would be quite at the top of the tree so far as the three Metropolitan Companies are concerned. As to the profit for the year, I think that exceedingly good. You have shown great wisdom in restraining yourselves from further expenditure of revenue in bringing your undertaking up to date. As you show 6½ p.ct. increase in business, that might justify you in putting 6½ p.ct. on your capital; but I suppose you have not reached that by a considerable way. At any rate, I think the purchase of land at Nine Elms—which gas-works was largely constructed in earlier days by my father and myself—is an extremely wise step, because there, by your ships, you increase your access to the sea. What many of the Companies round London suffer from is that they have no sea access. With regard to what the Governor has said about the comparative value of electricity and gas, I would like to refer to a speech made to the British Association by perhaps the most eminent engineering professor of the day. I allude to Professor G. W. O. Howe, D.Sc., Professor of Electrical Engineering at Glasgow University. He said, in the course of a long explanation as to why electricity cannot be generated cheaply: "Even now, with up-to-date steam plant and gasfilled lamps, the over-all efficiency from coal to light is not equivalent to more than 40 to 60 lbs. of coal out of each ton." If you take 50 lbs. of coal realized in electric power out of the 2240 lbs. of coal in a ton, you will see that they do not get more than about 2½ p.ct. on the best modern system. The greater demand for oil will make it dearer, and I congratulate you on not being very extensive users of it. You are setting a good example to those who make too great a use of this adjunct—the advantages of which are largely ephemeral. I have been very gratified to hear the remarks on the labour question. In this branch of work my son is associated with the Governor, and I am rejoiced to hear from him that the tact, good judgment, and discretion of Mr. Milne Watson, acting in this capacity, have been invaluable in bringing about the amicable understanding which has so long existed. My view of your undertaking is that you are in the front rank.

Mr. CHARLES MARSHALL: I should like, if I may, to congratulate you upon the extraordinary lucidity with which you have handled what is an extremely complicated and yet simplified balance-sheet. I came through the very beautiful showroom downstairs, and while admiring it I felt it was really too good for the position. Did you take into consideration the possibility of going out into the front—say, Victoria Street or the Strand—where everybody could admire your beautiful works of art? I do not see in the accounts anything of the cost of these handsome decorations. In my house I have not got electricity, I have gas; and I do not believe there is a house better lighted. Opposite is an electric lamp belonging to the Council, and recently when something went wrong with it the owners were two days repairing it. Near by a mantle was lately broken in one of the gas lamps, and this was renewed in two hours. We need not fear electricity so long as we have such an excellent service.

Mrs. G. W. POWELL, O.B.E.: Is it necessary to have men going, at considerable expense, round such districts as Knightsbridge, Kensington, and Chelsea collecting gas accounts which would be paid by cheque in the ordinary course of things without personal application?

The GOVERNOR: I am afraid the lot of the Company would be a very sorry one if we did not have collectors. There are thousands and thousands of prepayment consumers whose money we have to collect from the meter boxes, and there are many ordinary consumers in small houses who have no cheque book. As a matter of fact, the duty of the collectors is also to push gas, and they act to a certain extent as canvassers. Their visits to houses are therefore a most important part of our organization. If you do not follow-up your business, you get very little of it nowadays. The oftener the collector calls at a house and has a chat with the occupier, the better. As to the remarks of the second speaker, of course we should have been glad, had we had premises available in Victoria Street or some such place, to put showrooms there, but the cost of acquiring the necessary space would have been enormous. These premises have been the headquarters of the Gas Light and Coke Company for 113 years now, and as such are known throughout the length and breadth of the land. We receive visits constantly from people living in all parts of our district, who come to see us on business, and we want to be able to receive them worthily. Also the inspectors can send architects and others here to see what gas can do. The display will be quite utilitarian, though at the same time it is meant to attract the eye.

The resolution was then put to the meeting and carried unanimously.

THE DIVIDENDS.

The GOVERNOR: I will now ask the Secretary to read the minute of the Court of Directors recommending dividends for the past half-year.

The SECRETARY thereupon read the following from the Directors' minutes of Jan. 22:

> Resolved, that it be recommended to the Ordinary General Meeting of Proprietors, to be held on the 6th prox.: (1) That the sum of £20,000 be set aside out of the divisible profits of the Company for the half-year ending on the 31st day of December last towards the redemption fund, in accordance with the provisions of the Company's Acts of 1903 and 1909 and the Gas Light and Coke Company (Charges) Orders, 1921 and 1923; (2) that dividends as follow for such half-year be declared, namely:
>
> On the 4 p.ct. consolidated preference stock, at the rate of . . £4 0 0 p.ct. per annum
> On the 3½ p.ct. maximum stock, at the rate of . . . . . £3 10 0 ,, ,,
> On the ordinary stock, at the rate of . . . . . £5 6 8 ,, ,,
> All subject to deduction of income-tax.

These recommendations were adopted, on the proposition of the GOVERNOR, seconded by Mr. HENRY WOODALL.

RE-ELECTION OF DIRECTORS AND AUDITORS.

The GOVERNOR: I now have pleasure in moving the re-election as Directors of Mr. Joseph Lister Godlee and Mr. Henry Woodall, both of whom have been on the Board for a long time. I am sorry Mr. Godlee is kept at home by doctor's orders. We all wish him a speedy recovery. Mr. Woodall is too well known to you all to need any words from me.

Mr. R. M. HOLLAND-MARTIN seconded the motion, which was unanimously agreed to.

Thereafter the Auditors (Messrs. John Allen Stoneham and Percy Howard Ashworth) were re-appointed, on the proposition of Mr. H. RAYNER, seconded by Mr. A. BEVIS.

SALE OF LAND.

The GOVERNOR: Authority has to be asked of the proprietors for the sale and exchange of lands near Beckton Works. Both transactions arise out of the construction by the Ministry of Transport of the East Ham and Barking By-Pass Road, which forms part of one of the new arterial roads. No. 1 refers to land which the Company, on the suggestion of the Ministry of Transport, exchanged with the West Ham Corporation for another piece of equal area. The exchange has added greatly to the usefulness of the lands held by the Council and the Company on the south side of the road, and has minimized the inconvenience caused by severance due to the cutting of the new road. No. 2 refers to the land actually conveyed to the Ministry of Transport for the purpose of constructing the new road through the Company's property.

The necessary resolution was passed, on the motion of the GOVERNOR, seconded by Mr. WOODALL.

ACQUISITION OF THE BRENTFORD COMPANY'S UNDERTAKING.

EXTRAORDINARY MEETING.

The GOVERNOR: That concludes the business of the ordinary meeting, and I will call upon the Secretary to read the notice convening an Extraordinary Meeting to consider the Bill for the transfer to the Company of the Undertaking of the Brentford Company, to render further powers on the Company, and for other purposes.

The SECRETARY read the notice convening the meeting, and afterwards the heads of the Bill.

The GOVERNOR: Ladies and gentlemen,—You have just had read to you the heads of the Bill which is being laid before Parliament; and the sections which deal with the acquisition by the Company of the undertaking of the Brentford Company will no doubt strike you as being its most important feature. The Brentford Company have long been connected by sentimental ties with this Company. The two Companies have pursued more or less the same line of development; and it was thought by the members of the Boards of both sides that the time had arrived for the Companies to be merged into one. We have therefore come to an agreement for amalgamation which will, if Parliament approves, take place from Jan. 1 next. As regards policy, I feel sure it will be an advantage to both Companies. The Gas Light and Coke Company are naturally anxious to have a free opening to Greater London and the suburbs; and the enlarging of our district will, I am sure, be an excellent thing for the Company and the consumers generally. At the same time, the Brentford Company who, by the nature of their geographical position are cut off to a great extent from the advantage to be gained by possessing an easy access to the sea, will benefit by the facilities in this and other directions which the Gas Light and Coke Company can bring to them. The Bill will be duly placed before the Brentford Company's shareholders at a later date for their approval; but so far as this Company are concerned, I beg leave to move: "That the Bill now submitted intituled 'A Bill to provide for the transfer to the Gas Light and Coke Company of the undertaking of the Brentford Gas Company, to confer various powers upon the Gas Light and Coke Company, and for other purposes' be and the same is hereby approved, subject to such alterations as may be made in the Bill by Parliament and approved of by the Directors."

Mr. HENRY WOODALL: I have much pleasure in seconding the resolution.

Carried unanimously.

The GOVERNOR: That is all the business. I thank you for your attendance to-day.

A VOTE OF THANKS.

Mr. F. G. PILLEY: I wish to propose, and I am sure you will unanimously support it, a very cordial vote of thanks to the Governor and the Court for their services during the past year. You have heard the Governor's reference to the services of the engineers, staff, and workpeople, and with this you will all desire to associate yourselves. The results of the past year must be a great source of gratification to all concerned. We see increase piled upon increase, and under circumstances which have not been conducive to the best results. Then there is the proposed acquisition of the Brentford undertaking. You will agree that this must have meant a great deal of hard work and hard thinking before it was brought forward for the consideration of the proprietors. As to "The Rangers," we all know the fine reputation that battalion achieved during the war; and I understand that you, Sir, have recently accepted the command of it. I think it would be difficult to decide which is the prouder—you or the battalion—as the outcome of this appointment.

Mr. H. E. JONES: I should like to second that. The working results of this Company have improved extraordinarily, and in terms of therms you are quite above anything you ever reached before, and you will take a great deal of catching by other companies, though we shall try to do it.

The resolution was carried with applause.

The GOVERNOR: I thank you very heartily on behalf of my colleagues on the Board and myself, and the staff generally, for the kind things that have been said. The year has been a strenuous one, but the success that has attended our efforts has made it an extremely pleasant one. One never appreciates success so much as when one has to fight for it.

Glasgow Corporation and Coke-Oven Gas.—At a recent meeting of the Gas Committee it was agreed to confer with Messrs. James Nimmo & Co., Ltd., relative to their proposals to sell to the Corporation bulk supplies of coke-oven gas.

Fire at Perth Gas-Works.—A slight fire which occurred on Monday of last week at the Perth Corporation Gas-Works was happily soon got under control by the fire brigade. The outbreak arose in the petrol store, and when the brigade arrived two 50-gallon barrels were well alight. The store is near the sulphate of ammonia plant, but the firemen succeeded in preventing the flames from extending. The cause of the fire is attributed to a workman smoking while engaged in filling petrol tins.

Control of Subways.—The Westminster City Council have deposited in Parliament a Bill the object of which is to confer various powers upon them. One clause is to give the City Council authority to construct and maintain subways. The Highways Committee of the London County Council, while admitting that no indication is given as to the use to which such subways are to be put, express the opinion that subways for pipes and wires should be under the control of a central authority, and they recommend that the clause in question in the Westminster City Council Bill be opposed.

Dover Gas Company.—In their report for the year ended Dec. 31 last, the Directors mention that, notwithstanding two reductions in the price of gas during the year, amounting to 2½d. per therm, the gross profits total £11,526. Of this, £1000 has been carried to the reserve fund, and the Directors recommend a final dividend at the rate of 3¾ p.ct. (less income-tax), making, with the interim dividend, 7½ p.ct. for the year, together with a further 1 p.ct. on account of back dividends. The Directors have arranged to raise £35,900 by exercising the Company's unexhausted borrowing powers. They have instructed Messrs. A. & W. Richards to offer the amount for tender in the form of 5½ p.ct. irredeemable debenture stock.

Annual Dinner of Shrewsbury Gas Staff.—The third annual dinner and social evening of the staff of the Shrewsbury Gas Light Company was held on Thursday, Jan. 29. Mr. C. M. D. Belton (Engineer, Secretary, and Manager) presided, and was supported by Mr. J. B. Lloyd (Chairman of the Company) and other Directors. Mr. A. E. White proposed "Prosperity to the Shrewsbury Gas Light Company," whose Chairman in reply expressed the pleasure it gave him and his fellow Directors to be present at that gathering of the staff. Mr. Lloyd then proposed the health of the Engineer and Secretary, to whom he paid a warm tribute for his ability and enterprise shown in the development of the concern. The undertaking had gone through difficult times, but was now, he said, in a better position; and they looked forward to further progress in the future. A good musical programe was followed by a whist drive.

BRENTFORD GAS COMPANY'S STANDARD PRICE.

Application by the London County Council.

An inquiry was held on Monday, Feb. 2, by Mr. H. C. HONEY (Director of Gas Administration) into an application by the London County Council, under section 1 of the Gas Regulation Act, for a revision of the Brentford Gas Company's standard price.

The London County Council were represented by Mr. ROWAND HARKER, who had Mr. A. Valon as Technical Adviser; while the Brentford Gas Company were represented by Mr. W. E. TYLDESLEY-JONES, K.C., and Mr. JACQUES ABADY. Mr. William Cash was the chief witness for the Company; but evidence was also given by Mr. A. A. Johnston, the Engineer and Manager. Mr. Ralph Neville (Chairman of the Company) and Mr. Milne Watson (Director) were also in attendance.

A PRELIMINARY OBJECTION.

Mr. TYLDESLEY-JONES, on behalf of the Company, said that, before an amending Order under section 1 of the Gas Regulation Act could be made, it must be proved to the satisfaction of the Board of Trade that the costs and charges incidental to the production and supply of gas by the undertakers had substantially altered, owing to circumstances beyond their control. (Subsection 3, section 1.) That meant, of course, there must have been a change since the date upon which the Board of Trade fixed the original Therm Order, which, so far as the present case was concerned, was 1921. The onus of that was upon the applicant, in this case the London County Council, who had furnished the Company with a statement which merely showed the cost of production in 1914 and in 1923, and purported to indicate the alteration in the cost as between the two periods. According to the rules of procedure issued by the Board of Trade, the Council ought to have shown the difference in cost between 1921, when the original Order was made, and the date of the application for a revision. Consequently, strictly interpreted, the application was ill-founded. However, he was not pressing the point, because it would be common ground that there had been a reduction of costs since the original therm Order was granted.

Mr. HONEY suggested that it might result in a great saving of time at these inquiries if the company in respect of whose standard price the application was made were called upon by the Board of Trade to answer, by way of objections or representations, the application made for revision. In the case of an original application by a company for a higher standard price, the Board of Trade had insisted upon objectors sending in representations; and the same course might be pursued in Revision Orders.

Mr. TYLDESLEY-JONES pointed out that in Revision Orders the practice had grown up not to publish the proposal or the figures which the applicants proposed to put before the Board of Trade. Perhaps it might be convenient in future for applicants to give full details, and for the company concerned to lodge objections. At the present time, however, it would be impossible to ask the Company to lodge objections to something of which they were totally ignorant.

Mr. HONEY said there seemed to be a good deal of force in what had been said; and the point would be considered.

Mr. TYLDESLEY-JONES, after consultation with the Directors, said he did not desire to press the point, and the matter was not discussed further.

THE CASE FOR THE LONDON COUNTY COUNCIL.

Mr. ROWAND HARKER said the pre-war standard price of the Brentford Company, reduced to a price per therm, was 9d. The Company applied for a revision of price in February, 1921, and the Board of Trade made an Order on March 31, 1921, giving a standard price of 17·8d., indicating that the increase in cost as compared with pre-war was 8·8d. per therm. Since this Order was made, there had been a fall in the cost of supply of 4·64d. per therm, and Mr. Valon would suggest in his evidence that the standard price should now be 13·2d. per therm. In arriving at this figure, Mr. Valon had not taken into account any question of the savings the Company had made. If any such claim were made, it would have to be dealt with after the details were known.

The Brentford Company acquired the Richmond and Harrow undertakings on Jan. 1, 1924; but in order to avoid possible complications, Mr. Valon had based his estimate on the Company's accounts for 1923—a policy which the Company agreed was the best in the circumstances.

MR. VALON'S EVIDENCE.

Mr. Valon said he had taken the 1923 accounts. In arriving at his present estimate of standard price he had taken the same quantity of coal carbonized as in 1923—namely, 270,940 tons at 34s. 11d. per ton. This gave a total expenditure of £473,016, which, however, did not agree with the figure appearing in the balance-sheet, because the latter figure was a composite one which included not only coal but an amount for depreciation in the value of boats. The average price of the coal contracts entered into in June, 1924, was 33s. 10d. per ton; so that he was giving the Company an advantage on coal. For coke he had taken the 1923 figure of 26s. 6d. per ton, and the same quantity sold. Similarly, breeze had been taken as in 1923. The revenue from tar was high in 1923, and the price obtained last year by the Company was above what might reasonably be expected in the future. In 1923 it was 6·26d. per gallon; but he had estimated 4·72d. per gallon. He had taken the 1923 figure for sulphate of ammonia. In this way the figure obtained for net coal was 9·9d. per 1000 c.ft.

The figure taken for oil was 5½d. per gallon, as against an actual cost of 4·93d. per gallon in 1923. The 1923 figures for coke and breeze, salaries and wages (with an adjustment for the increase on Jan. 1, 1925), and purification, were taken. Coming to repairs and maintenance of works and plant, Mr. Valon explained how his total figure of 9·51d. per 1000 c.ft. was made up, as compared with the actual figure of 8·75d. per 1000 c.ft. spent by the Company in 1923. In dealing with repairs of mains and services he had worked on exactly the same basis as in regard to repairs and maintenance of works and plant—namely, by taking the 1914 figures and applying a factor. The total figure, including depreciation, was 3·34d. per 1000 c.ft. The same principle was applied to the repairs of ordinary meters, his figure being 0·55d. Repairs of stoves were dealt with in a similar manner. The estimate was 2·24d. per 1000 c.ft., as against the Company's actual expenditure of 2·3d. in 1923. In dealing with prepayment meters and fittings a factor of 66 p.ct. had been adopted for the reason that the cost of materials in this particular respect had not increased by such a large amount as in connection with the other items. His figure for prepayment meters and fittings was 1·54d., compared with an actual expenditure of 1·50d. in 1923. He had arrived at a figure for the total net expenditure on revenue account of £801,366, or 39·04d. per 1000 c.ft. Interest on temporary loans, debentures, and mortgages was then dealt with, the allowance made being 0·78d. per 1000 c.ft. In this way Mr. Valon arrived at a figure of 39·82d. per 1000 c.ft. Adjusting the figures to a therm basis, the following is his final calculation of the 13·11d. now suggested by him as the new standard price for the Company.

Mr. Valon's Estimate of Standard Price.

		Pence per Therm.
Standard Price—		
Fixed by Board of Trade (1921)	17 8	
Pre-war standard price, 45d. at 500 B.Th.U.	9 0	
Increase in cost of supply under Gas Regulation Act, as found by Board of Trade		8·80
Estimate of present cost of supply—		
39·82d. per 1000 c.ft. at 479 B.Th.U.	8·31	
Pre-war cost of supply—	d.	
Year to June, 1914	21·74	
Less bad debts, £1084	0·07	
At 516 B.Th.U.	21·67	4·20
Increase in cost over pre-war		4·11
Fall in cost of supply		4·69
Existing standard price		17·80
New standard price		13·11 (say) 13·2d.

Mr. Valon added that he had not made any allowance in this figure of 13·2d. for any savings which the Company might have been able to make through causes within their control, and to that extent the figure was subject to such modification as the Board of Trade might see fit to make after hearing the evidence. In conclusion he mentioned that, as in previous cases, he had made a check estimate, taking the figures of 1923 without any adjustment; and the figure he arrived at was 13·07d. per therm.

Mr. TYLDESLEY-JONES discussed with witness the advisability of remodelling the Brentford Works—as a matter of fact, reconstruction work is now in progress there—and said that the beneficial results upon supply would inure to the advantage of the consumers.

Witness considered it would be a good policy to reconstruct the works. It would largely reduce the working costs, which in turn should reduce the price of gas, and so increase the margin between the standard price and the selling price, which would be to the advantage of the Company.

Mr. TYLDESLEY-JONES said that, if the outlay in respect of capital expenditure was charged to revenue, the benefits would ultimately be shared between the consumer and the shareholder.

Witness replied that, in this event, the bulk of the expenditure would be met by the consumer, and not by shareholders.

Witness, re-examined by Mr. HARKER, said the most important point of difference between the two sides in this case was as to the remodelling of the Brentford Works. Both sides were agreed that it was desirable, though they differed as to the incidence of the cost of the necessary capital.

MR. CASH'S EVIDENCE FOR THE COMPANY.

Mr. TYLDESLEY-JONES did not make a preliminary statement on behalf of the Company, but proceeded at once to call evidence.

Mr. *William Cash* handed in a series of tables showing how he had arrived at a new standard price of 14·85d. per therm. (This was subsequently reduced to 14·72d. per therm.) The basis of his calculations were the figures of the year 1923, as in Mr. Valon's case; but there were certain differences, which were explained. His figure for coal was 33s. 10d. per ton, which was lower than Mr. Valon's figure, though both had excluded any charge for depreciation on ships. For tar he had taken 2¾d., though the net price realized in 1923 was 6·26d. per gallon. His views as to the future of tar did not coincide with those of Mr. Valon. On repairs and maintenance of works and plant, Mr. Cash arrived at a figure of 9·75d. per 1000 c.ft., or, including depreciation, 9·85d., against Mr. Valon's 9·51d. He explained that though his basis was the same as Mr. Valon's, he arrived at a factor of 99 against Mr. Valon's 92, owing to the difference in the wages paid. Similarly, in regard to repairs and maintenance of mains and services, his figure was 3·90d., against Mr. Valon's 3·43d. Discussing his figures for repairs and maintenance of meters, and prepayment meters and fittings, and renewals of stoves, witness said he had taken the 1923 figures for the purpose of the new standard price. For prepayment fittings his figure was 1·21d. per 1000 c.ft., against Mr. Valon's 1·17d.; in the other two items there were only slight differences between the estimates on the two sides.

Witness then came to the question of interest on temporary loans, debentures, or mortgages, which, he said, raised a serious point. There had been a heavy expense on capital account since 1914; and if this was to be left out of account as regards allowing interest on capital, a state of affairs would be produced which, from the point of view of gas administrators, would be a deterrent to any company spending money on capital account unless they were absolutely driven to do it. Since June, 1914, there had been a very big increase in

the interest paid on borrowed money. In the case of the Brentford Company the rate for debentures was from 6 to 7½ p.c., whereas previously the rate was never more than 4 p.c. This was the direct result of the war; but this money was not working capital. Roughly speaking, the money now borrowed for the purpose of giving supply cost 2 p.c. more than in 1914. Further, a larger sum of money had had to be spent since 1914 upon capital account than would have been necessary if there had been no war. The following table was handed in showing the increased rate of interest paid, and comparison between the actual capital expenditure and what would have been required on the basis of 1914 costs. Mr. Cash's total figure for interest on temporary loans and consumers' deposits, debentures or mortgages, and special purposes fund, was 3·76d. per 1000 c.ft., against 0·78d. allowed by Mr. Valon.

Statement showing the Increased Rate of Interest Paid.

LOANS OUTSTANDING.

At June, 1914.		At December, 1923.	Per Annum.
£		£	£
206,250 at 4 p.c.	Debenture stock .	221,400 at 4 p.c. =	8,856
	Mortgages . . .	194,700 at 6 ,, =	11,682
		36,100 at 7 ,, =	2,527
		300,000 at 7½ ,, =	22,500
		£752,200	£45,565

Average rate = 6·06 p.c.
Increased rate of interest: 2·06 p.c.

Statement showing the Actual Capital Expenditure and Expenditure which would have been necessary if costs had not increased.

Year.	Capital Expenditure.	Cost Factor of Increase.	Expenditure if no Increased Costs.
	£		£
1915	19,567	113·5	17,239
1916	12,806	136	9,416
1917	11,313	153	7,394
1918	9,568	190·4	5,025
1919	20,553	249	8,254
1920	84,269	307·5	27,404
1921	193,434	290·5	66,586
1922	113,552	210·7	53,893
1923	174,279	190·5	91,485
	£639,341	—	£286,696

Increased expenditure due to increased costs . . £352,645

Total Increase in Interest Charges due to Increased Costs.

	£		
2·06 p.c. on £639,341 . .	13,170		
4 p.c. on £352,645 . .	14,105		
Working capital, 5 p.c. on (say) £112,000	5,600		
		£32,875	Per 1000 c.ft., 1·6d.

Mr. Cash then handed-in his estimate of what should be the new standard price, which is shown in the following table.

Mr. Cash's Calculation of New Standard Price.

	Per 1000 C.Ft. d.		Per Therm. d.
Cost and manufacture and distribution, year ended June, 1914.		21·74	
	d.	d.	
Deduct repairs of works included in above	4·90		
Deduct repairs of mains included in above	1·77		
		6·67	
Add the average for 3 years— Repairs of works	4·90		
Repairs of mains. . . .	1·90		
		6·80	
			0·13
			21·87
Less income-tax (1914) . .			0·13
			21·74 at 516 = 4·21

	Per 1000 C.Ft. d.		Per Therm. d.
Cost of supplying gas to-day. Cost	44·40 at 479 =		9·27
Add for increase in wages, Jan. 1, 1925—viz., 4 p.c. on £186,386 . = per annum £7455 . . . . . =	0·365 ,,		0·08
Add for reconstruction at Brentford works = per annum, £21,500 . . . =	1·05 ,,		0·22
Add for cost of amalgamation with Harrow and Richmond, spread over 4 years (say) per annum £13,000 . . =	0·64 ,,		0·13
			9·70
			5·49
Add for savings			0·36
			5·85
Original standard price 3s. 9d. at 500 = per therm . . .			9·00
New standard price			14·85*

* Reduced to 14·72d.

Witness said that the cost of the amalgamation with Harrow and Richmond, which appeared in his calculation, could be struck out.

Mr. HONEY: I had already done that mentally. (Laughter.)

Thus the new standard price of 14·85d. appearing in Mr. Cash's table above is reduced to 14·72d. by the deduction of 0·13d. per therm represented by the cost of the amalgamation.

Mr. HARKER, cross-examining witness, said that Mr. Cash had in some items taken the pre-war average figure and multiplied it by a factor representing the increased cost since pre-war, while in others he had taken the figures as in 1923. The items in regard to which he had adopted the 1923 figures were repairs and maintenance of meters, stoves, and fittings. Witness said that his reason for doing this rather than arriving at a factor was that the Company were spending more per 1000 c.ft. in this connection than previously.

With regard to the question of making an allowance to the Company in respect of the increased interest on money borrowed at present as compared with pre-war, Mr. Harker suggested that the position was that if the Company were entitled to benefit in respect of this increased interest, it would mean that a company which chose to raise the whole of its necessary capital by loan would be able to make a substantial charge against the cost of the gas, or, rather, to add a substantial item to "the costs and charges incidental to the production of gas," whereas a company which chose to raise exactly the same amount of money, for the same purpose, by share capital, might not be able to do so.

Mr. HARKER asked if witness would say that this increased interest which the Brentford Company had to pay was part of the cost "of and incidental to the price of gas."

Witness said he did, for the purposes of the present calculation, bearing in mind that the object was to fix a standard price for the capital.

Mr. HARKER said that in no circumstances could the Company properly claim interest at pre-war rates on so much of the money as they would have had to spend if they could have got the work done at pre-war rates. Was Mr. Cash putting forward, as a matter of principle, that any gas company which, on future improvements, spent any sums of money they thought necessary out of borrowed money, would be entitled under the Act to say that the interest on the whole of that borrowed money was a cost and charge beyond their control?

Witness said he was. The Company would have to spend the money because they were under an obligation to give the supply.

Mr. HONEY asked whether the charge for the reconstruction of the Brentford Works was not a proper charge against the special purposes fund.

Mr. *Cash* said that he was not sure that it was. The Company had to put the works into a proper state of repair and spend money to modernize them, which was rather different from what was contemplated by the special purposes fund.

Mr. HONEY, after further discussion, said they seemed to be in general agreement that in the case of an original application for a standard price on the therm basis, as distinct from an application for a revision, capital expenditure could hardly be taken into account, because, if it were, in fact, remunerative capital expenditure, it was within the control of the Company, and it had not increased the costs. This was always put forward as a criticism, that a progressive Company were somewhat penalized by the terms of the Act, inasmuch as they could not get credit for enterprising expenditure of capital.

THE ENGINEER'S VIEWS.

Mr. *A. A. Johnston* (Engineer and General Manager of the Company) supported Mr. Cash's evidence as to the prices of tar and sulphate of ammonia. Witness handed-in charts showing the costs incurred by the Brentford Company and the Metropolitan Companies (per 1000 c.ft. of gas sold) in respect of repairs to works, mains, meters, and stoves, from 1911 to 1923, to show that the figures put forward by the Brentford Company were not excessive. He estimated the total savings effected by improved working as 0·36d. per therm, as shown in Mr. Cash's estimate of the standard price. As to the reconstruction of the Brentford Works, this was imperative, and certain provisions had already been made with this object in view. His estimate of the cost of reconstruction was £340,000. A figure of 0·22d. per therm would represent the annual expenditure on repair and maintenance of the Brentford plant during the reconstruction period.

The matter having been gone into very thoroughly, it was agreed by Counsel to forego their closing speeches.

SOUTH SUBURBAN GAS COMPANY.

Annual Report.

In submitting the accounts for the year ended Dec. 31 to the annual meeting of the Company next Friday, the Directors will present the following report, signed by the Chairman (Mr. Charles Hunt).

The quantity of gas sold during the year has increased by 9·52 p.c., as compared with the previous year, and the number of consumers has increased by 3360. The number of gas cookers sold or hired to consumers has increased during the year by 7105, of which 2556 have been sold.

The accounts show that, including the balance of £696 10s. 11d. brought forward from the previous year, and an amount of £10,000 taken from the reserve fund, and after providing for all debenture and other interest charges and payment for the first half of the year of a statutory dividend at the rate of 6½ p.c. per annum, less income-tax, there remains a balance of £37,153 19s. 5d., out of which the Directors recommend payment for the second half-year of a dividend at the rate of 6½ p.c. per annum, less income-tax, leaving the sum of £717 6s. to be carried forward to next account. An amount of £100,000 of the Company's 5 p.c. ordinary stock was offered by tender in October last, and was issued at an average price of £103 17s. 1d. p.c. The bonus payable to co-partners, based on their earnings, is 4¾ p.c., as against 4½ p.c. in 1923.

The Directors retiring by rotation are Mr. Charles Hunt and Dr. Charles Carpenter, who, being eligible, offer themselves for re-election. Mr. W. G. Waller, Employees' Director, has been re-elected unopposed. Mr. E. D. Davey (Auditor) retires by rotation, and, being eligible, offers himself for re-election.

NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

The week was quiet throughout, and the demand showed no signs of expansion for any sorts of coal. News of more pits closing has not surprised those in close touch with the market. Many collieries were able to keep going last year owing to good contracts fixed up in the early months. These have in many cases not been renewed at all, and certainly not at prices which are of much help with costs at the present rate. A great many collieries are in a very uncertain position, and very few can see their way more than a week or so ahead.

Gas makes still fetch the best prices, nominal quotations being 21s. 9d. for Wear specials, 21s. 3d. for best qualities, and 18s. to 18s. 3d. for others. Durham unscreened bunkers are weaker; even best makes cannot get 19s. f.o.b. Coking sorts are in poor demand.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

The slight flicker observable in the market for industrial coal a week or two back proved transient. It is not easy to persuade consumers that the uncertainties of the outlook make freer buying a sound proposition. Consumptive requirements are little, if any, larger. Increased activity in some directions is neutralized as far as the coal market is concerned by inert conditions elsewhere. Throughout the iron and steel producing districts the position is very discouraging. Heavy engineering gives no sign at present of fulfilling the hopes which were entertained a month or two ago. It follows that many of the collieries are poorly off for orders. What with industrial depression and the absence of any stimulus in the house coal department the turnover is very disappointing for this season of the year. Pits are working on the average four-and-a-half to five days a week. D.S. nuts provide the brightest spot in the market. They are in good demand, and prices are relatively strong. The highest grades of house coal maintain their value, but going down the scale there is regular retrogression—not a sudden decline, but the attrition of continued unpropitious conditions.

Blast furnace coke supplies are still proportioned to actual consumptive requirements, and in this way depreciation is avoided. Pig iron is being bought only in small lots.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

Gas coals in Yorkshire and Lancashire are moving slowly under contract, and apparently renewals during the coming month will be at prices below those of last year. The mildness of the weather has to some extent contributed to this.

The consumption of industrial coal does not show much improvement in Yorkshire, and there appears to be a general feeling of uncertainty in regard to the immediate future. Many of the principal trades are working from hand-to-mouth, and are, therefore, quite undecided as to what the next few months will bring. This applies particularly to the iron and steel and the woollen industries. In Lancashire industrial fuel is in moderate demand at 22s. at the pits for unscreened coal, and there is a fair demand for the higher class of slacks. Yorkshire collieries producing some of the lower grade fuels are quoting reduced prices; and although these result in occasional business, the total is not satisfactory.

The house coal trade in both counties is more or less normal, while the export market continues dull and seems likely to do so for some time.

Furnace and gas cokes continue to decline in value, and the outlook for the summer is not encouraging to the trade.

Prices at Hull at the week-end were: Bunkers—Yorks., Derby, and Notts. large screened steam, f.o.b. Humber ports, 17s. 6d. to 19s. 6d. per ton. Cargo for export, f.o.b. usual shipping ports—Best Yorks. hards, 21s. 3d. to 21s. 6d.; Derby best hards, 21s. 6d. to 22s.; best Yorks. Hartleys, 18s. to 21s. 6d.; South Yorks. washed doubles, 21s. to 21s. 6d.; ditto washed singles, 21s.; dry doubles, 15s. 6d. to 18s. 6d.; South Yorks. washed smalls, 16s. 6d.; Derby slack, 1 in., 11s. 9d. to 12s.; South Yorks. rough slack, 12s.; gas coke, 21s. 6d. to 24s. 6d.; foundry furnace coke, 20s. 9d.; washed smithy peas, 23s. 6d. to 25s.; washed steam thirds, 20s; South Yorks. washed trebles, 23s.

Theft from a Gas Meter.—At the Sheriff Court, Glasgow, on Monday of last week, a man named John Spencer was convicted on a charge of breaking into a house, forcing open a gas meter box, and stealing 13s. 6d. therefrom. It was stated that accused had a number of previous convictions against him. He had been going from door to door selling writing pads, and when there was no response to his knocking he attempted to open the door with a key. The Sheriff sent him to prison for twelve months.

Bath Gas Light and Coke Company.—The report of the Directors for the year ended Dec. 31, 1924, will be presented at the annual meeting to be held on Feb. 18. It states that the quantity of gas sold constitutes a record in the history of the Company, being over 1000 million c.ft., and an increase over the previous year of 6 p.ct. The income from the sales of residuals was well maintained during the early months of the year; but during the latter part both sales and prices declined. Contracts have been entered into for extension of the carbonizing plant, to meet the increased demand for gas. An interim maximum dividend of 5 p.ct. per annum was paid for the half-year ended June 30, 1924; and the Directors recommend the declaration of a dividend at the same rate, less income-tax, for the half-year ended Dec. 31.

TRADE NOTES.

Crankless Gas Compressor.

We learn that Messrs. George Waller & Son, Ltd., Phœnix Iron Works, Stroud, are the sole licencees for the manufacture in this country of the crankless gas compressor, to which reference was made in last week's "JOURNAL."

A Booklet on Refractories.

The Derbyshire Silica Firebrick Company, Ltd., of Friden, who manufacture refractory materials for all purposes, have published an interesting illustrated booklet giving particulars of their Friden Works, and the methods of manufacture of their widely known products.

Blackburn Contracts.

The Blackburn Gas Committee decided, at their last meeting, to accept the tenders of Messrs. R. & J. Dempster, Ltd., of Manchester, for a four-lift spiral guided holder and steel tank at the Greenbank Gas-Works, and for a two-lift spiral guided relief holder and steel tank; also the tender of Messrs. Humphreys and Glasgow, Ltd., of London, for a carburetted water gas plant.

A Coal Drier at Sheffield.

The Nunnery Colliery Company, Ltd., of Sheffield, a short time ago placed an order with the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., for a Carpenter centrifuge, specified to dry 40 tons of wet coal per hour, down to a figure not exceeding 8 p.ct. This drier has now been erected, and is expected to be in operation as soon as another plant required in connection with the general scheme has been completed.

CONTRACTS OPEN.

General Stores (Tubes and Fittings, Mantles, &c.).

The Gas Department of the County Borough of Stoke-on-Trent are inviting tenders for works materials, &c. (See advert. on p. 362.)

Coal.

The Plymouth Corporation Gas Committee are prepared to receive tenders for the supply of 34,000 tons of gas coal. (See advert. on p. 362.)

Welded Steel Pipes.

The Gas Committee of the Manchester Corporation are inviting tenders for the supply of 36-in. welded steel pipes. (See advert. on p. 362.)

Cast Iron Pipes.

Tenders are invited by the Bridgwater Gas Light Company for 1100 yards of 6-in. cast iron pipes, together with specials. (See advert. on p. 362.)

Dismantling and Pulling Down Retort Bench, &c.

The gas department of the borough of Keighley are inviting tenders for the dismantling and pulling down of a horizontal retort bench, &c. (See advert. on p. 362.)

Stores, Tools, &c.

The Corporation of Ossett invite tenders for the supply of materials, stores, workmen's tools, &c., required for several departments, covering a period of twelve months. (See advert. on p. 362.)

Coke Benches, Hoppers, and Handling Plant.

Tenders are invited by the Manchester Corporation Gas Committee for the supply, delivery, and erection, at their Bradford Road works, of coke benches, hoppers, and handling plant. (See advert. on p. 362.)

EXTENSIONS.

New Plant for Belfast.

In order to provide for the growth in the output of gas at Belfast, it is necessary to procure additional condensers, exhausters, and washers, and these will be erected on the site of the old horizontal retort house now being demolished. The estimated cost is £16,000, with an additional £3000 for foundations and tar and liquor wells. Application is being made to the Ulster Ministry of Labour for an Unemployment Relief Grant in respect of the preparation of the foundations.

Dover Gas Debentures.—In our advertising pages will be found an announcement by Messrs. A. & W. Richards, of No. 37, Walbrook, E.C., that they have been instructed by the Directors to offer for sale by tender £35,900 of 5½ p.ct. perpetual debenture stock of the Dover Gas Company, at the minimum price of par. The growing demands for gas render necessary extensions of the works, plant, and mains. Tenders must be sent in to the firm not later than Thursday morning, Feb. 19.

Tottenham District Light, Heat, and Power Company.—The accounts for the year ended Dec. 31, which will be submitted at the annual meeting next Tuesday (Feb. 17), show, after payment of dividends in respect of the half-year ended June 30, 1924, at the rate of 5 p.ct. per annum on the preference stock, 8 p.ct. per annum on the "A" stock, 6½ p.ct. per annum on the "B" stock, all less income-tax, and providing for interest and all other charges, an available balance (including a sum of £35,810 brought forward from the last account) of £68,425. The Directors recommend the confirmation of the above-mentioned dividends, and the payment of dividends, in respect of the half-year ended Dec. 31, at the rate of 5 p.ct. per annum on the preference stock, 8 p.ct. per annum on the "A" stock, and 6½ p.ct. per annum on the "B" stock, all less income-tax. The Board of Trade held an inquiry on Jan. 26, 1925, with reference to the application of the Middlesex County Council, for a revision of the present standard price of the Company. The decision has not yet been given. The quantity of gas sold was 6·44 p.ct. more than during the year ended Dec. 31, 1923.

STOCK MARKET REPORT.

THE news that a section of Stock Exchange dealers have passed a resolution declining to deal in British Corporation or Colonial Stocks that have not been the subject of public issue, indicates a lack of imagination that is surprising in these usually very much alive persons; and, if it were possible, it would be interesting to ascertain a few years hence whether the determination has been faithfully kept by any individual supporter of the resolution. We may next expect, perhaps, a decision to the effect that brokers will only transact business on behalf of clients who have acquired the stocks or shares to be dealt with through the medium of a stock exchange.

While the gilt-edged market remained quiet there was a distinct revival of business during the past week in other directions. The account on Thursday was fairly large, but the rates were on the low side. The repayment of the 5¾ Exchequer Bonds brought in new funds for investment. India Stocks, which for a long period have been depressed, were more in demand.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Feb. 6.	Rise + or Fall − on Week.	Transactions Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Feb. 5	5	5	Aldershot 5 p.c. max. C.	78—81*		
235,492	,,	,,	4	4	Do. 4 p.c. Pref.	71—76*	−2	83
1,531,868	,,	Sept. 25	6	6	Alliance & Dublin Ord.	64—69	−1	
374,000	,,	Jan. 8	4	6½	Do. 4 p.c. Deb.	61—66	..	..
300,000	5	Oct. 23	8	4	Bombay, Ltd.	..	..	..
100,000	10	Aug. 14	8½	8½	Bournemouth 5 p.c.	5—5⅛	..	..
425,050	10	,,	7	7	Do. B 7 p.c.	12½—13½	..	£5/3/0
150,000	10	,,	6	6	Do. Pref. 6 p.c.	12½—13	..	..
50,000	Stk.	Jan. 8	3	3	Do. 3 p.c. Deb.	10½—11½	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	56—59	..	..
992,045	,,	July 10	6 7/8	6 7/8	Brentford A Con.	76—79	..	..
990,500	,,	,,	6⅞	6⅞	Do. B New	112—117	..	..
76,000	,,	,,	5	5	Do. 5 p.c. Pref.	112—117	..	..
306,690	,,	Dec. 18	4	4	Do. 4 p.c. Deb.	89—94	..	..
181,337	,,	,,	—	6	Do. 6 p.c. Rich. Red. Deb.	75—80	..	..
214,740	,,	Aug. 28	11½	11½	Brighton & Hove Orig.	100—105	..	..
244,200	,,	,,	8½	8½	Do. A Ord.	170—175	..	..
1,287,500	,,	July 24	5	5	Bristol 5 p.c. max.	125—128	..	..
855,000	,,	Sept. 25	7	8	British Ord.	95—96a	..	..
100,000	,,	Dec. 18	7	7	Do. 7 p.c. Pref.	115—120	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	123—128	..	118½
100,000	10	Dec. 18	8	6	Cape Town, Ltd.	72—77	..	..
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref.	7—8	+½	..
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb.	6—7	..	7⅛
626,860	,,	July 24	6	6	Cardiff Con. Ord.	71—76	..	..
237,860	,,	Jan. 8	7½	7½	Do. 7½ p.c. Red. Deb.	97—100	..	73½
157,150	,,	Aug. 14	6¾	7⅛	Chester 5 p.c. Ord.	105—108	..	..
1,513,280	,,	July 24	6	5	Commercial 4 p.c. Cap.	91—96b	..	..
560,000	,,	,,	6	6	Do. 3½ p.c. Cap.	94—97	..	..
475,000	,,	Dec. 18	3	3	Do. 3 p.c. Deb.	91—97	..	..
800,000	,,	14 Jan. 15	—	—	Continental Union, Ltd.	57—60	..	95—96½
200,000	,,	Dec. 18	7	7	Do. 7 p.c. Pref.	40—45	..	95—96½
660,000	,,	Aug. 28	6½	6½	Croydon sliding scale	88—92	..	..
284,975	,,	,,	5	5	Do. max. div.	102—105	..	40—40½
492,370	,,	Aug. 28	9	6	Derby Con.	84—87	..	..
55,000	,,	Jan. 8	4	4	Do. Deb.	107—110c	..	..
1,002,180	1£	Jan. 22	6	4	European, Ltd.	74—76c	..	..
16,460,070	Stk	Aug. 14	5½	5½	Gas Light & Coke 4 p.c. Ord.	8—9	..	..
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	96—98	..	8—8½
4,062,235	,,	,,	3½	4	Do. 4 p.c. Con. Pref.	63—66	−1	97—96½
4,761,930	,,	Dec. 18	4	3	Do. 3 p.c. Con. Deb.	80—82	..	65½—66
130,000	,,	—	10	10	Do. 10 p.c. Bonds	60—63	..	82
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	61¼—62
82,500	,,	Sept. 11	6½	6½	Hastings & St. L. 5 p.c. Conv.	95—100	..	..
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	75—80	..	..
70,000	10	Sept. 25	10	10	Hongkong & China, Ltd.	16—17	..	97
86,600	Stk.	Aug. 14	10	10	Hornsey 7 p.c.	138—143	..	77
1,976,000	,,	Nov. 20	10	10	Imperial Continental Cap.	180—185	..	..
263,950	,,	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	69—72*	..	..
335,242	,,	Aug. 14	6½	6½	Liverpool 5 p.c. Ord.	97—102	−1	182½—186
2,127,340	,,	Aug. 14	5½	5½	Do. 7 p.c. Red. Pref.	93⅞—94⅛b	..	..
600,000	,,	Sept. 25	7	7	Maidstone 5 p.c. Cap.	100—109b	+½	..
165,736	,,	Aug. 28	8	9	Do. 3 p.c. Deb.	125—135	..	94
63,480	,,	Dec. 18	3	3	Malta & Mediterranean	54—59	..	105—107½
75,000	5	Dec. 4	7	5	Montevideo, Ltd.	3¾—4	..	132
541,920	Stk.	Nov. 20	4	4	Newcastle & Gateshead Con.	62—67	+¼	..
1,875,892	,,	July 24	5½	5	Do. 4 p.c. Pref.	87¼—88¼d	..	..
250,166	,,	,,	4	4	Do. 3 p.c. Deb.	74—75d	..	..
529,705	,,	Dec. 18	3½	4	North Middlesex 10 p.c.	68—69d	..	..
15,000	10	Aug. 28	11	3½	Do. 7 p.c.	16—17	..	..
75,940	10	,,	7 7/16	11	Oriental, Ltd.	11½—11¾	..	..
300,000	Stk.	Dec. 4	7	7 7/16	Plym'th & Ston'house 5 p.c.	100—105	..	..
138,120	,,	Jan. 8	7⅛	9	Portsea Island B	109—114	..	..
60,000	50	Aug. 28	13	7⅛	Do. C	99—102	..	..
100,000	50	,,	12	13	Primitiva Ord.	95—100	..	..
2,289,909	1	—	—	12	Do. 4 p.c. Red. Deb.	9/6—10/6	−/6	98—99
311,100	100	Dec. 1	4	—	Do. 4 p.c. Red. Deb. 1911	78—80	..	9/7½—10/3
600,000	Stk.	Jan. 22	4	4	Do. B. Aires 4 p.c. Rd. Db.	63—65	..	79⅞
820,335	,,	Dec. 18	4	4	Do. R'r P'te 4 p.c. Rd. Db.	65—67	..	..
321,670	,,	,,	4	4	San Paulo 6 p.c. Pref.	65—67	..	..
130,000	10	Sept. 25	6	4	Do. 5 p.c. Red. Deb.	7⅛—8	..	..
125,000	50	Jan. 2	5	6	Sheffield A	41—43	..	..
270,000	Stk.	Aug. 28	5/8/4	5	Do. B	104—106e	..	..
419,968	,,	,,	5/8/4	5⅛	Do. C	104—106e	..	..
1,047,000	,,	,,	5/8/4	5⅛	South African	104—106e	..	104½
90,000	10	Oct. 23	8	5⅛	South Met. Ord.	7—9	..	..
6,609,895	Stk.	Aug. 14	6½	6	Do. 3 p.c. Deb.	101¼—103½	−1	..
1,893,445	,,	Jan. 8	4	5	Do. 6½ p.c. Red. Deb.	59—62	..	102—103¼
734,000	,,	Sept. 11	3½	4	South Shields Con.	104—106	..	60—60½
91,500	,,	Aug. 28	6½	3	South Suburban Ord. 5 p.c.	137—139d	..	..
1,087,795	,,	Aug. 14	8½	6½	Do. 5 p.c. Deb.	107—112	..	..
368,837	,,	Dec. 18	6½	8½	South'mpt'n Ord. 5 p.c. max.	96—99	..	110
647,740	,,	Nov. 6	5	6½	Do. 4 p.c. Deb.	83—86	..	..
121,275	,,	Dec. 18	5	5	Swansea 7 p.c. Red. Pref.	72—77	..	84—85
250,000	,,	Aug. 28	4	5	Do. 6½ p.c. Red. Deb.	102—104	..	..
200,000	,,	Dec. 18	7	4	Tottenham District A 5 p.c.	102—104	..	103½
120,000	,,	July 24	6½	7	Do. B 3½ p.c.	119—122	..	..
882,275	,,	,,	8	6½	Do. 4 p.c. Deb.	102—105	..	..
181,235	,,	Dec. 18	6½	8	Tynemouth Con. and New	75—79	..	103¾—104
258,251	,,	Aug. 28	4	6½	Uxbridge, Maidenhead, & Wycombe 5 p.c.	84—86d	..	77½
			7/14/4	4	Do. 5 p.c. pref.	102—107	..	..
187,294	,,	Aug. 28	6½	5	Do. 5 p.c. Maidenh'd	95—100	..	..
68,330	,,	Aug. 28	—	6½	Wandsworth, Wimbledon, and Epsom—	93—98	..	..
91,800	,,	—	—	5	Wandsworth A 5 p.c.	140—145	..	..
30,000	,,	July 10	9½	9½	Do. B 3½ p.c.	120—125	..	..
255,636	,,	,,	7½	7½	Do. C	102—107	..	..
108,075	,,	,,	6/7/9	6/9/6	New Ordinary	..	..	..
240,865	,,	,,	6/7/9	6/9/6	Wimbledon 5 p.c.	116—121	..	..
352,000	,,	,,	7½	7½	Epsom 5 p.c.	122—127	..	..
98,000	,,	,,	7½	7½	5 p.c. Deb.	57—60	..	..
88,416	,,	Dec. 18	3	3				

Quotations at :—a.—Bristol; b.—Liverpool, c.—Nottingham, d.—Newcastle, e.—Sheffield. * Bx. div.

Iron, Coal, and Steel shares were mostly idle though steady, which remark also applies to Textiles. Tobaccos were well supported on the excellent accounts of the Imperial Tobacco Company.

It will be seen by the Table that the changes in the quotations in the Gas Market have been unimportant. It will be noticed that the Gas Light and Coke ordinary dropped 1 point. This fall, coming, as it does, simultaneously with the warning of dearer gas which the Governor of the Company gave at the general meeting on Friday last, is significant. Two more dividend announcements have been made in the London area. The South Suburban Company maintain the dividend of 6½ p.ct. per annum for the past half-year, and the Tottenham Company are again recommending 8 p.ct. and 6½ p.ct per annum respectively on the two stocks of the Company.

The following transactions were recorded during the week: On Monday, Aldershot "C" 83, British 118¼, Commercial 4 p.ct. 96½, 3½ p.ct. 96½, 96½, Continental Union 40, 40½, European 8, 8¼ *ex* div., Gas Light and Coke 97⅛, 97⅝, 98¼, 3½ p.ct. maximum 66, Imperial Continental 183, 184, 185, Liverpool 7 p.ct. preference 105, Maidstone 5 p.ct. 132, Primitiva 9s. 9d., 10s., 10s. 3d., South Metropolitan 102½, 103, 103¼, 103⅜, South Suburban 5 p.ct. 110, Southampton 84, Swansea 7 p.ct. preference 103¾, Tuscan 25s. Supplementary prices, Southend-on-Sea 4 p.ct. debenture 75.

On Tuesday, Gas Light and Coke 97⅛, 97⅞, 98, 98⅛, 98¼, 3½ p.ct. maximum 65¼, 66, Imperial Continental 183¾, 184, 184½, 185, 186, South Metropolitan 103¼, 103½, Southampton 5 p.ct. maximum 84½, 85, Tottenham "B" 103¾. Supplementary prices, Southgate and District 4 p.ct. debenture 76¾.

On Wednesday, Commercial 4 p.ct. 95, Gas Light and Coke 97⅛, 98⅛, 98¼, 3½ p.ct. maximum 66, 3 p.ct. debenture 62, Imperial Continental 184, Portsea Island "C" 98, 99, Primitiva 9s. 9d., 10s., South Metropolitan 102, 102½, 103, 103⅛, 103½, 3 p.ct. debenture 60, 60½, Tottenham "B" 104.

On Thursday, Cape Town 4½ p.ct. 1st mt. debenture 73½, Commercial 4 p.ct. 95½, 96, European 8, 8⅛, Gas Light and Coke 97⅛, 97⅝, 97⅞, 98, Hastings and St. Leonards 5 p.ct. 97, 3½ p.ct. 77, Imperial Continental 184, 184½, 185, Primitiva 9s. 9d., South Metropolitan 102¾, 103, Tottenham "B" 104. Supplementary prices, Bournemouth 7 p.ct. debenture 108½, 108⅝.

On Friday, Bombay £5 3s. 0d., Cape Town 7⅞, Commercial 3½ p.ct. 95, European 8 1/16, Gas Light and Coke 97, 97½, 3½ p.ct. maximum 66, 4 p.ct. preference 82, 3 p.ct. debenture 61½, Imperial Continental 182½, 183, 183¾, Primitiva 9s. 7½d., 9s. 9d., 4 p.ct. debentures 79⅜, South Metropolitan 102, Tottenham 4 p.ct. debenture 77⅜, Tuscan 25s.

In spite of the payment of the final instalment of the recent issue of Conversion Loan, money was plentiful in Lombard Street at the close of the week. The usual rate for old or new day-to-day loans did not exceed 2½ p.ct., and borrowers in some cases secured money at as low as 2 p.ct. Treasury Bills were allotted at £3 14s. 3·67d. p.ct., which practically showed no change on the previous week's average rate.

Business on the Foreign Exchanges was quiet, and there was very little fluctuation in rates. Sterling dropped slightly in relation to the dollar, and finally closed at 4·78 3/16. Allied exchanges continued to decline. French francs finished at 88.70, Belgian francs at 93, and Italian lire at 115⅝.

Silver remained quiet and declined ⅛d., to 32⅛d. per oz. Gold was quoted 1d. higher at 87s. 2d. per oz.

The Bank rate is 4 p.ct., to which it was raised from 3 p.ct. on July 5, 1923. Bankers' deposit rates are 2 p.ct. The deposit rates of the discount houses are 2 p.ct. at call and 2¼ p.ct. at notice.

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Feb.* 9.

In the London tar products market little business is being done in pitch, and the price is quite nominal.

Creosote remains unaltered at about 7½d. per gallon net and naked at makers' works.

Solvent naphtha (95/160) is about 1s. 8d. per gallon, pure toluole about 1s. 10d. to 1s. 11d. per gallon, and pure benzole 1s. 11d. to 2s. per gallon.

Tar Products in the Provinces.

Feb. 9.

There has been little alteration in the market for tar products during the past week.

Pitch continues weak, and with an almost entire absence of Continental demand. Business has been done at East Coast ports at prices varying from 42s. to 43s.

Creosote oil is still firm, and the majority of sellers are holding for a slight advance on to-day's quoted prices.

Benzole is still firm with a good demand.

Solvent naphtha is steady, and a fair amount of business has been done with consumers.

Naphthalene, carbolic, tar acids, and anthracene are all weak, and business is very difficult to negotiate.

The average values for gas-works products during last week were: Gas-works coal tar, 32s. to 37s. Pitch, East Coast, 42s. to 44s. f.o.b. West Coast—Manchester, 38s. to 39s.; Liverpool, 39s. to 40s.; Clyde, 42s. to 43s. Benzole, 90 p.ct., North, 1s. 7½d. to 1s. 8½d.; crude, 65 p.ct. at 120° C., 9¼d. to 10¼d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 2d. to 1s. 3d. Toluole, naked, North, 1s. 7½d. to 1s. 8½d., nominal. Coal-tar crude naphtha, in bulk, North, 7¼d. to 8d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, North, 1s. 1d. to 1s. 2d. Creosote, in bulk, North, liquid, 6¾d. to 7d.; salty, 6⅝d. to 6⅝d.; Scotland, 6⅝d. to 6¾d. Heavy oils, in bulk, North, 6¾d. to 7d. Carbolic acid, 1s. 9d. to 1s. 10d. prompt. Napthalene, £12 to £14; salts, £4 to £5, bags included. Anthracene, "A" quality, 3d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

Cardiff Gas Company.—The profit of the Cardiff Gas Light Company for the year ended Dec. 31, 1924, was £66,344. Interim dividend was paid on the consolidated stock at the rate of 6 p.ct. per annum, and on the preference stock at the rate of 4½ p.ct. per annum; and the Directors recommend the payment of a final dividend on these stocks at the same rates, less income-tax.

Fleetwood Gas Company.—The half-yearly report of the Company shows a capital expenditure for the six months of £2278. New mains and services cost £1855, and £422 was expended on new meters. On revenue there was a profit of £2192, reduced by loan interest to £1803. The Directors recommend dividends at the rates of 7½ p.ct. per annum on the preference stock and 6½ p.ct. on the ordinary stock (both less tax), leaving a balance of £394 to carry forward.

Weymouth Consumers' Gas Company.—The report of the Directors for the half-year ended Dec. 31, 1924, shows continued progress in the output of gas. The quantity sold was 472,449 therms, as against 465,675 therms for the corresponding half of the year 1923—an increase of 1·45 p.ct. Though the quantity of gas sold was greater, the receipts were less by £183. This is accounted for by a reduction in the price, which is now 10d. per therm. The balance at the credit of the net revenue account is £12,943. From this the Directors recommend the payment of a dividend for the half-year on the ordinary stock at the maximum rate of 5 p.ct. per annum, less income-tax.

Gas Light and Coke Company's Bill.—At a meeting of the Middlesex District Councils' Association, when the Bill of the Gas Light and Coke Company for the acquisition of the Brentford Gas Company's undertaking was down for consideration, Mr. A. J. Lees (Secretary of the Urban District Councils' Association) attended by invitation, and gave a lucid exposition of the effect on the gas consumers of certain clauses. It was decided: "That those local authorities whose districts are situated within the area of supply of the Brentford Gas Company be advised to take into serious consideration the provisions of the Gas Light and Coke Company's Bill, particularly clause 38, and to lodge objections against the Bill, with the view to subsequent concerted action.

Gas and Electricity for the Whitmore Estate.

In connection with the Whitmore Estate, Hoxton, it has been agreed that contracts be entered into with (1) the Shoreditch Metropolitan Borough Council for the supply of electricity for lighting, cooking, and heating purposes; and (2) with the Gas Light and Coke Company for the supply of gas for cooking and heating to tenements in the first block of dwellings on the estate; subject in each case to the installations including fittings, lamps, and stoves being provided and maintained free of cost to the Council. The Shoreditch Borough Council are prepared to wire all the tenements, and to provide and maintain appliances with the exception of lamps, which will be renewable by the tenants. For lighting purposes the current will be supplied through prepayment meters. The present rate is 8d. per unit. For heating and cooking the supply would be through separate meters at 1½d. per unit. The Gas Light and Coke Company offer to carcass the tenements for cooking and heating free of charge, leaving each individual tenant to decide whether gas cookers and fires shall be installed. The Borough Council and the Gas Company will be given equal facilities to canvass incoming tenants as regards the supply of electricity or gas.

Efficiency in Business.

Until the end of the present week (Feb. 14), office administrators have presented to them an opportunity of seeing assembled a great number of appliances designed to secure—and capable of fulfilling this intention—more efficient business organization, and consequently better working results. The display referred to is at Central Hall, Westminster, in connection with the seventh Business Efficiency Exhibition, organized by the Office Appliance Trades Association, with the object of demonstrating to business people the advantages of better machinery and methods in the office. Not alone to employers, but to employees as well, is the exhibition of interest; for there are demonstrations of how daily duties can be performed with more speed, less effort, and greater accuracy, and the value of the work thereby enhanced. One of the typewriters will write in a bound book; while facsimile letter printing machines will produce at the rate of 3000 an hour, and at very low cost, letters which are indistinguishable from typewritten ones. There are accounting, tabulating, adding, and calculating machines of extraordinary ingenuity; book-keeping machines, and timing and costing clocks. There may be inspected the most modern ideas in departmental telephones, including loud-speaking instruments, dispensing with receivers and enabling the business man to converse without holding a receiver, at any distance up to 50 ft. from the instrument. A postal franking machine automatically feeds, seals, stamps, stacks, and counts outgoing mail matter in one operation at the rate of 250 a minute. Money is correctly paid out at the touch of a button by an automatic cashier; and there are fountain pens which may be fed with ink cartridges.

Brighouse Workers' Dispute.—It was announced before the expiry of the notices on Thursday last that, in the Brighouse gas-workers' demand for regrading on a higher basis of payment, a temporary agreement between the men and the Corporation had been reached. The Gas Committee decided to accept any award arrived at by the Joint Industrial Council as being retrospective in application to Jan. 22, and agreed to meet the men's representatives in the event of the Joint Industrial Council failing to function within fourteen days of Feb. 5, the date of the termination of the men's notices. The men, on their part, agreed to suspend the notices until Feb. 19, and to accept the finding of the Joint Industrial Council.

The Ministry of Health have sanctioned a loan to the Manchester Corporation of £50,000 for gas apparatus in connection with slot installations during the year ending Dec. 31, 1925.

The Halifax Corporation Gas Department had an attractive stand at an Ideal Homes Exhibition recently held at the Halifax Hall. The stand was devoted chiefly to domestic appliances.

A letter has been received by the Blackburn Rural District Council from the Ministry of Health approving the installation of gas in the Council's houses, and stating that the Ministry will be prepared to sanction a loan to cover the cost.

The Teignmouth Urban District Council have accepted a tender at £3410 for the construction in mass concrete of a proposed retaining wall and retort foundations at the gas-works, and are applying to the Ministry of Health for sanction to a loan covering the cost of the work.

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Jan. 26, 1925.

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Can be Inspected on Application to the RESIDENT ENGINEER, GAS-WORKS, MARINE PARADE, SOUTHAMPTON.

FOR SALE— Complete Sets of RETORT BENCH IRONWORK.
BATES AND SONS, WIGSTON LANE, AYLESTONE, LEICESTER.

STEAM-BOILERS For Sale—All Sizes, Vertical, Loco-type, Cornish, Portable, and Other Types of Boilers.
Apply
GRANTHAM BOILER & CRANK CO., LTD., GRANTHAM.

FOR SALE — 10,000 feet of 8-in. WELDLESS STEEL SPIGOT and SOCKET PIPING, Lengths 16-18 Feet, Never Laid, Coated, immediate Delivery. Also 3500 feet of 8-in. ditto, Coated and Wrapped. Suitable for Main. Low Price to clear.
GEORGE COHEN, SONS, & CO., LTD., 600, COMMERCIAL ROAD, LONDON, E. 14.

CONTRACTS OPEN.

BOROUGH OF DARWEN.

TENDER FOR THE SUPPLY OF OXIDE OF IRON.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the Supply of 250 Tons of OXIDE of IRON, Delivered at their Siding, for Gas Purification purposes at their Works.
All Particulars may be obtained from Mr. A. H. Smith, Gas Engineer, to whom all Samples are to be sent.
Sealed Tenders, endorsed "Oxide," to be Delivered to the undersigned not later than Saturday, the 21st of February, 1925.
The lowest or any Tender will not necessarily be accepted.
By order,
HARRY ROTHWELL,
Town Clerk.
Town Clerk's Office,
Jan. 29, 1925.